SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

FRIDAY, OCTOBER 25, 1901.

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MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION F, ZOOLOGY.

THE first meeting of the Section was called to order by Vice-President David Starr Jordan, on Monday, August 26, at 11:30 a.m., when the Section was organized with the following officers:

Vice-President, David Starr Jordan.
Secretary, Henry B. Ward.
Member of Council, C. H. Eigenmann.
Member of General Committee, V. L. Kellogg.
Sectional Committee: C. B. Davenport, Vice-President, 1900; C. H. Eigenmann, Secretary, 1900; D. S. Jordan, Vice-President, 1901; H. B. Ward, Secretary, 1901; E. P. Felt, W. H. Ashmead, T. D. A. Cockerell.

The report from the Committee on Variation was read, and on motion the Section voted to recommend the granting of the funds requested for prosecuting the work. The report is as follows:

The grant of one hundred dollars to this committee was used to help defray the expenses of Mr. C. C. Adams incurred in collecting for study molluscs of the genus *Io*, found in the headwaters of the Tennessee River. A preliminary report has been made by Mr. Adams, and this was printed in the *Proceedings* of the Association for 1900. Mr. Adams submits at this time a second report covering the results of study on the material collected last summer, but prefers to postpone further publication until after his final expedition which he is

making this summer. The main results so far are that he has shown, by the aid of an elaborate series of measurements, that the numerous species of *Io* run into each other in a very complete way, and that the differences between the shells are associated with their position up or down stream. Nevertheless, there is in most streams a more or less marked discontinuity between the smooth, globular, up-stream shells and the spiny, elongated down-stream shells. The meaning of the discontinuity (which justifies, in a way, a division of the shells into two species) is still not perfectly clear. To test certain hypotheses in respect to this discontinuity, Mr. Adams has returned to the field this summer. This piece of work is, we believe, the largest and most thoroughgoing quantitative study of the variation of a species in nature that has yet been reported upon.

The committee request the council to grant it one hundred dollars additional, to aid Mr. Adams in this his final summer's work on this topic.

The committee is glad to report an increasing interest in the quantitative study of variation, and especially the establishment by Professors Pearson and Weldon of a new journal, *Biometrica*, devoted to the results of such study.

Respectfully submitted,

F. Boas,
Chas. S. Minot,
J. McK. Cattell,
Chas. B. Davenport,
C. H. Eigenmann.

The following resolution was also passed requesting an appropriation for the Concilium Bibliographicum from the funds of the general society:

In view of the very limited sum at the command of the Committee on Grants, and recognizing also the fact that this money has hitherto been devoted only to the encouragement of research, this Section would recall its request that a grant be made from these funds to the Concilium Bibliographicum.

As an important aid to research, already firmly established, of great assistance to investigators and capable of development so as to serve a wider usefulness, this Section regards the Concilium Bibliographicum as particularly deserving of support and encouragement, and to the end that such financial assistance as is necessary may be given, requests that a special appropriation of $50 from the general funds of the Association be made for this purpose, and placed at the disposal of an advisory committee of three, consisting of President Minot, together with two other members or fellows appointed by him.

On Monday, at 3 p. m., the Section listened to the address of Vice-President Davenport on 'The Zoology of the Twentieth Century,' which, in the absence of Mr. Davenport, was read by the secretary.

On Wednesday morning the Section adjourned to hear the address of Vice-President Jordan before Section G on 'Political and Social Conditions in the Hawaiian Islands.'

At a meeting of the General Committee on Thursday evening, Professor C. C. Nutting, of the University of Iowa, Iowa City, was elected vice-president and chairman of the Section for 1902, and Dr. Charles W. Stiles of the Bureau of Animal Industry, Washington, D. C., was elected secretary for 1902.

The following papers were presented before the Section and, so far as given by the authors, the abstracts for each are appended.

1. 'The Fish-Fauna of Japan, with Observations on the Distribution of Fishes': David Starr Jordan, President of Stanford University. Published in Science for October 11.

2. 'On the Morphology of the Pineal

Region based upon its Development in Acanthias': CHARLES SEDGWICK MINOT, LL.D.

The paper describes the development of the epiphysis, the posterior and superior commissures, the velum transversum and the paraphysis in the embryos of the dog-fish, of from 11.5 to 86.0 mm., studied chiefly by means of median sagittal sections. The velum transversum arises close to the epiphysis, and, unlike other known types, the dog-fish retains this relation permanently. The velum gives rise by its lateral expansion to the choroid plexus of the lateral ventricles. In front of the velum is the paraphysial arch, which is not identical with the paraphysis. This arch exists in all vertebrates, but has not hitherto been recognized as a constant morphological constituent of the brain. The true paraphysis arises as a small evagination from the paraphysial arch, and appears very late in development—in the oldest embryo examined it was not clearly present, so that it is uncertain whether it exists in the dog-fish at all. In amphibia and birds it is easily found, and there develops into a glandular organ, never, so far as known, into a sense-organ, as has been generally assumed hitherto. The single duct opens into the cavity of the brain. We may assume, in default of actual knowledge, that the gland supplies a secretion to the brain, being physiologically comparable to the infundibular gland of the lower vertebrates. In amphibians the velum transversum expands so much that it grows forward and across in front of the paraphysis; the enlarged velum is wholly transformed into the adult choroid plexus, as a part of which the paraphysial gland was long regarded erroneously. In birds and mammals the median portion of the velum is rudimentary or obliterated; the paraphysial arch is well developed and forms a large part of tela choroidea superior; the later portions, on the contrary, are greatly developed to form the lateral plexus.

3. 'The Essential Mechanism of Hearing in Man': HOWARD AYRES.

4. 'On the Disappearance of the Vast Flocks of Wild Pigeons (*Ectopistes migratoria*) in Eastern North America': EDWARD T. KEIM, Denver, Colo.

In the memory of the middle-aged man many facts can be recalled relating to the annual flight of the myriads of wild pigeons through the Eastern, Middle and Central States of the United States of America. The newspapers of that period (1850 to 1870 and 1880) teemed with accounts of the vast numbers seen, and the superlative adjective was immoderately used to describe the great number and the indiscriminate slaughter. Certain wooded sections in the States of Kentucky, Tennessee, Missouri, Iowa, Illinois, Minnesota and Michigan, when the white settlers first came into these regions, were visited annually by the pigeons for nesting places, but owing to the almost ceaseless attacks by man, beast and bird, these localities were deserted for a year or more. Another fact also observed was that the abundance or scarcity of the 'mast' and the wild fruits and grains, which constituted their main food, determined the location of the annual nesting places. An account of a visit by the writer in company of a party of hunters, to the so-called pigeon roost near Maquoketa, Jackson county, Iowa, will be given, and a map of the United States showing approximate location of known breeding places will be exhibited. An effort will be made to secure mounted specimens of the male and female pigeon.

5. 'The Eleven Elements in the Superior Molar Teeth of Mammals' (illustrated by models): HENRY F. OSBORN.

6. 'The Homologies of the Mouth Parts of Insects with Complete Metamorphosis': VERNON L. KELLOGG.

Despite the continued attention of entomologists through nearly one hundred years to the problem of the homologies of the insect mouth parts, an agreement has not yet been reached as to the interpretation of these homologies in the Diptera and perhaps in other holometabolic groups. The extreme modification of certain parts and the reduction to mere unintelligible vestiges, or, indeed, to total disappearance, in the imaginal condition of the more specialized flies and the fact that even in the generalized flies the fully developed mouth-parts are so modified that a comparison with the typical biting or orthopterous mouth is difficult and hazardous, has determined this long-continued uncertainty in the determination of the mouth-part homologies. For the problem has been heretofore attacked exclusively, or nearly so, by the method of the comparative study of the fully-developed mouth structures. It is certain that no absolute determination of the homologies can be reached by this method alone. I have therefore made an attempt to trace the development of the imaginal mouth parts in the Diptera, Lepidoptera, Coleoptera and Neuroptera, while a student of mine, Mr. A. B. Spaulding, has undertaken similar work on the Hymenoptera. The special difficulty of the work lies of course in the remarkable histolytic and histogenetic conditions attending the post-embryonic development of the holometabolic insects.

It is perfectly feasible to trace continuously the development of mouth parts of the dipterous larvæ, from the first budding of the appendages on the successive head segments to fully developed larval condition. But the utter casting aside at pupation of these larval mouth structures and their supplanting by the radically different imaginal parts, which have developed from imaginal histoblasts (derived from the larval hypoderm) make it impossible to trace a perfect continuity from embryonic anlagen to the definitive imaginal structures.

But we find in the advanced larva that the developing imaginal structures push out into and perfectly correspond with the larval parts,and that an interpretation of the homologies of the adult mouth parts in any of the holometabolic insects can be got at on the basis of this correspondence in position.

The value of this evidence from position is made apparent when the development of the imaginal mouth structures in holometabolic insects with biting mouths, as the Neuroptera and Coleoptera, are studied. There is no question in the minds of entomologists regarding the certainty of the homologies of imaginal mandibles, maxillæ and labium of these insects with the same parts of the imaginal orthopterous mouth. But a study of the development of the imaginal mouth parts in the Neuroptera and Coleoptera has revealed that perfect correspondence in position between the developing imaginal parts and the larval parts, as is apparent in the Diptera, Hymenoptera and Lepidoptera.

I have, therefore, been able to show that the interpretation of the homologies of the imaginal dipterous mouth parts formerly advanced by me (see papers on *Psyche*, 1900) on the basis of a comparative study of the fully-developed imaginal mouth structures, in all the generalized families and several of the specialized families is confirmed by the evidence derived from a study of the post-embryonic development of the imaginal parts. And further, this study shows that the ordinarily accepted interpretation of the homologies of the imaginal mouth parts of the other holometabolic orders of insects is confirmed by the study of their development.

7. 'On Taxonomic Relations between Scolytids and their Host Plants': A. D. Hopkins, Entomologist, W. Va. Agric. Exp. Sta.

This paper embraces some of the results of the author's studies of the host plants of nearly all the described, and some 100 undescribed, North American Scolytidæ, which in addition to the literature containing references to the plants infested by these beetles in all countries, enables him to bring together for comparison a more comprehensive list of the insects and plants, than has ever before been possible. The species of insects with observed or recorded host plants represent some 500 species, 52 genera, 20 sub-groups, 7 groups, and 3 sub-families. All the host plants are found to belong to the Phanerogamæ. The Gymnospermæ are represented by 1 order, 13 genera and 30 species. The Angiospermæ by 1 order and 1 species in the Monocotyledons, and by 36 orders, 56 genera and 120 species in the Dicotyledons. The paper is illustrated by a chart, showing the relations of the primary and minor divisions in the classification of the insects with those of the plants. The genus of plants infested by the species of any genus or group of insects is shown in horizontal spaces, while the genera of insects, connected with any genera or group of plants, are shown in vertical spaces, crossing the horizontal ones. Thus the relations of genera to genera, and group to group, are presented in a most convenient manner for study and comparison. In the relations observed there seem to be some facts of considerable taxonomic importance which, if properly interpreted, and taken in connection with structural characters of the insects, will aid materially in determining natural affinities. When we came to consider these facts, and apply the evidence they furnish, towards the solving of some taxonomic problems, some rather striking results were obtained, which have guided us to the discovery of some valuable specific, generic and group characters in the insect, heretofore entirely overlooked. Closely allied species and genera, which had been relegated to far corners in different groups, have been brought together, and order is being restored where there was much confusion. The evidence found in the fossils of Eocene rocks, and in amber, indicates that the Scolytidæ reached a high stage of development at the beginning of the Tertiary, and that it is not at all improbable that a maximum development was attained during the Jurassic or Cretaceous. We find the sequoia, and other survivors of ancient groups of conifers; the tulip, sassafras, oaks, elms, beeches, poplars and other survivors of primitive genera, and groups of other plants, supporting what are believed to be the oldest surviving types of groups and genera of Scolytidæ. This, together with the evidence furnished by the records of the host plants of existing species, furnishes guides and suggestions towards a clear conception of the probable lines of evolution of present forms from primitive generalized groups. They suggest that the progenitors of the Scolytidæ may have found their way into the soft bark and wood of conifer-like trees of the first true forest in the Devonian; or of the thick soft bark of the great tree ferns, Sigillaria and Cicades, of the Carboniferous, and that from these progenitors of the Gymnosperms, Monocotyledons and Dicotyledons the descendants of the insects have adapted themselves to the physiological changes in the evolution of their hosts, sharing with them the struggle for existence through the changes in surface and climate, from age to age, and from period to period, to the present.

8. 'Some Recent Observations on Culicidæ': L. O. HOWARD, chief entomologist, U. S. Department of Agriculture, Washington.

An account of some new work on the biology of *Aëdes*, *Psorophora*, *Megarhinus* and *Stegomyia*.

9. 'The Larva of *Pyrrharctia isabella* as an Anatomical Subject': E. P. Felt, N. Y. State entomologist, Albany, N. Y.

The availability and desirability of this larva is shown and a few general statements made in regard to its internal anatomy. Attention is also called to an internal parasite and its relations to its host. Two small drawings illustrate the paper.

10. 'On the Development and Evolution of the Scolytid Gallery': A. D. Hopkins.

This paper embraces some of the results of the author's special study of the galleries of the large number of described and many undescribed North American Scolytidæ, together with those figured from all countries, so far as available; representing in all some 400 species, 37 genera, 13 sub-groups, 7 groups and 3 subfamilies. Brief reference is made to the structural character, and characteristics of habit, which distinguish this family of beetles. In the galleries three fundamental forms, or types, are recognized: (1) The longitudinal, (2) the transverse, (3) the broad, irregular chambers which, modified or combined, form the specific types of all galleries, and these seem to fall naturally into eight primary groups and thirty-two divisions. The primary groups are designated as follows: (1) The primitive forms; (2) broad, irregular, branching forms; (3) the ambrosia galleries; (4) the intermediate or transverse branching forms; (5) the longitudinal, branching forms; (6) the double, transverse; (7) the double longitudinal; (8) the single longitudinal, or higher forms. The paper is illustrated by numerous lantern slides from photographs, and by drawings of typical forms of galleries; also by a chart which shows the relations of the various genera, sub-groups, groups and sub-families, to the groups of galleries, in horizontal and vertical spaces. The various forms of the galleries throughout the family, so far as observed, range from the simplest longitudinal burrow (excavated in decaying bark or wood), as the primitive type, to the complex or composite form (with its many radiating branches from a central chamber), as the intermediate, and to the short, straight, longitudinal egg gallery (with its symmetrical radiating brood burrows in living bark), as representing the highest type. It is seen from a study of this diagram, that a group of allied forms of galleries does not necessarily represent any single group of species, but that the several groups of galleries represent parallel or periodic stages and relations in the evolutionary development of all the groups.

Thus if the characters, as expressed by the gallery, are properly interpreted as indicating a stage or period in the evolution, and are studied in connection with structural characters of the insects, it will indicate the natural position of a species, in its relation to other species in its group, and to similar stages and periods in other groups. The results of this line of study and thought, incompletely expressed as they are in this paper, may serve at least to suggest the course of evolution of the scolytid gallery within the maximum and minimum limit of an instinctive idea or tendency common to all individuals of the family, but expressed in varying degree as the different, low, intermediate and higher species and individuals are capable of expressing it. This suggests a parallel with the social development of the human species, in the evolution of the idea common to all, of constructing a habitation in which to rear and protect a family of offspring, as has been expressed in varying degree from the simplest to the highest perfection. It may suggest the importance of considering the law of parallel development of characters and characteristics, in species of remote, as well as near, affinity, and thus enable us to

eliminate some of the errors in our systems of classification, where a character, due to parallel development, has been mistaken for one of near affinity. And finally the results of this study of the gallery, together with the results of a study of the parallel relation of structural characters, indicate a law of parallel or periodical relation of groups of organisms somewhat similar to that of the chemical elements.

11. 'The Eye of the Blind Lizard *Rhineura floridana*': C. H. EIGENMANN, Bloomington, Ind.

The eye has been withdrawn from the surface; the tear glands are enormous as compared with the eyeball, which is very small, the optic fiber layer forming a central strand. The optic nerve does not extend to the eye. The layers of the retina have retained a high degree of specialization.

12. 'The Ontogenic Development and Degeneration of the Eye of the Blind Fish *Amblyopsis*': C. H. EIGENMANN, Bloomington, Ind.

The history of the eye of *Amblyopsis* may be divided into four periods: (1) The period of palingenic development ending when the fish is about 4.4 mm. long. (2) The period of direct development, during which the eye develops directly from a palingenic stage to the highest development the eye reaches—at the end of 10 mm. in length. (3) The period of progressive modification, during which the eye undergoes many changes without reaching a more perfect condition as an organ of vision. This ends when the fish has reached full maturity. (4) The period of degeneration ending with death; during this period the eye is gradually wiped out.

13. 'The Finding of the *Leptocephalus* of the American Eel': C. H. EIGENMANN, Bloomington, Ind.

Among many *Leptocephali* in the United States National Museum were found two which on account of their great resemblance to the *Leptocephalus* of the European eel and on account of their differences from that of the European eel, which were just the differences between the adults, were considered the *Leptocephali* of the American eel. They were taken off New York.

14. 'A Gigantic Campanularian, with Observations concerning its Systematic Relations': C. C. NUTTING, Iowa City, Iowa.

15. 'The Harvard Embryological Collection': CHARLES S. MINOT, LL.D.

The collection was founded in connection with the Embryological Laboratory of the Harvard Medical School. It is intended to be used primarily for research work in the comparative embryology of vertebrata. It is proposed to have carefully graded stages of eighteen or more species, chosen as types of vertebrate classes, and to have of each stage three sets of serial sections in three planes—transverse, frontal and sagittal. The collection is to be thoroughly catalogued, every section being numbered. The paper describes the precise method used, the growth of the collection and other details.

16. 'On a New Type of Secretion by the Formation of Spherules': by CHARLES S. MINOT, LL.D.

The process here recorded was first observed in the glands of the cervix of the human uterus. The end of the epithelial cell, next the lumen of the gland, assumes a clearer appearance, becomes distended and then breaks off as a spherule, which lies in the gland cavity. The spherule breaks down, and its substance forms the secretion of the gland. Certain observations indicate that the same type of spherular secretion recurs in the mesonephros (Wolffian body of the pig, embryo, kidney of the frog). Mingazzini has described a somewhat similar spherule formation occurring on the basal ends of the epithelial cells of the intestine, during the resorption of food.

17. 'Laws of Adaptive Radiation': Henry F. Osborn.

18. 'Potential, Latent or Parallel Homology as distinguished from Phyletic or Derivative Homology (illustrated by Models)': Henry F. Osborn.

19. 'The Phylogenetic Relations of the Simple Vertebrates': Howard Ayres.

21. 'A Study of the Variations in *Sympetrum rubicundula* Say and *S. obtrusa* Hagen': Morton J. Elrod, University of Montana.

These two species of Odonata are separated from each other on the relative sizes of the divisions of the bifid hamule, those having a little more than the apical third bifid being classed as *rabicundula*, those having the genital hamule with a fourth bifid being classed as *obtrusa*. The observations are based on the study of 394 specimens, from Maine to Montana, 223 being males. The aim of the author is to determine if the relative portions of the bifid hamule are a constant factor, and to determine if there are other factors that may be used for separation of the species.

Sixteen tables of figures are given, showing the variations observed in the fore and hind wings of both males and females, the length of males and females, the number of ante-cubitals, postcubitals and cross nervures of the fore and hind wings of the right and left sides of both males and females, the length of hamule of males, the relative widths of the bifid portions of the males, and the vulvar lamina of the females. The results of the measurements are as follows: The antecubitals and postcubitals are very irregular in number. There is a high percentage of both males and females of both species with five antecubitals on the hind wings. The antecubitals are much more constant than the postcubitals. The females show greater variation than the males. The left side shows greater variation than the right. The antecubitals on fore wings vary from six to nine, on hind wings from four to seven. Postcubitals on fore wings vary from five to ten, and on hind wings from five to eleven. The males have more cross nervures than the females. Three-fourths of all the specimens have a less number of cross nervules on one wing than on the other. There is great variation in the length of the hamules. The comparison of the bifid portions of the hamules does not justify the separation into two species. There is no appreciable difference in the wings or length of body of the two species. No differences of consequence could be observed in the vulvar laminæ of the females. The two species should be reduced to one, *S. rubicundula* Say, and a new description of the species written, which description is given in the paper. The variety *assimilata* is retained.

22. 'Further Studies in the Geographical Variation of *Io*': Chas. C. Adams, Zoological Department University of Chicago, Chicago.

23. 'A Preliminary Statement of the Alkalinity of the Blood in Infections and the Infusion of Salts derived from Horses' Blood as a Therapeutic Measure': A. Emil Schmitt, New York City.

Based on the premises that the degree of alkalinity in the blood of certain species of lower animals, as horse, dog and cat, is greater than that in man, and that it is a causative factor in their immunity, and also that the alkalinity of the blood in man is reduced in the infections, and that by the infusion of alkaline solutions this can be increased and the infection thus overcome, the writer suggests the use of the salts derived from the horses' blood-ash and reports cases of puerperal septicæmia and cerebro-spinal meningitis thus treated. The views on the question of alkalinity are sustained by a number of authors, and the advantage accruing from the use of the salts derived from horses' blood-ash are set forth and compared with the prepared solutions of

salts composed according to analyses of blood-ash. The relationship of degree of alkalinity of blood and the incubation period of infections, as well as the immunity enjoyed by the black races, as also instances among the white race, and especially with lower animals compared with man, are hinted at.

No definite results as a therapeutic measure are claimed, but the author wishes to suggest a new trend of thought which will attack disease at its very foundations, altering the composition of the blood and body juices to make them uninhabitable for germ propagation. Introduction by means of infusion into the veins at the elbow instead of subcutaneously is resorted to on account of the pain and possible change of composition in the latter method. 500–1,000 cc. of the 1-per-cent. salt solution are infused at one time, controlled by the condition of arteries and heart. With this strength neither a dissolution nor a crenation of the corpuscles takes place, as demonstrated under the microscope, the isotonic coefficient of human blood compared with various strengths of this solution varying from .44–.58 per cent. No harmful effects have been noticed and venesection, to rid the body of some of its toxines in serious cases, is considered a valuable adjunct to the new form of treatment.

24. 'Cold as a Causal Factor in the Blood Changes due to High Altitude': JOHN WEINZIRL, Albuquerque, New Mexico.

Up to the present time no satisfactory explanation of the blood changes due to high altitude has been offered. The more commonly accepted hypothesis that the increased blood counts are due to diminished atmospheric pressure, or that more red corpuscles are required to furnish sufficient oxygen to the tissues when the oxygen supply is diminished, has serious objections to it. In the first place, the oxygen absorption by the hemoglobin of the red cells is a chemical phenomenon independent of the partial pressure of oxygen. Secondly, it is not at all plain why an increased number of red cells should be required to carry a given amount of oxygen, for, as Paul Bert has shown, the amount of oxygen actually used by an animal is constant even when the supply is diminished by one-half, or when pure oxygen is respired. Nor are the various other hypotheses that have been offered more satisfactory than the above. An experiment with common white rabbits, planned to test some of these hypotheses, accidentally revealed the fact that extreme temperature changes or a change from a warm to a cold temperature, produced all the phenomena of high altitude; and that when the animals were subsequently taken to a higher altitude the usual phenomena did not ensue.

That the blood counts made in winter are higher in red cells than those made in summer has been previously observed, and comparative tests by the writer confirm this fact. An important factor in altitude changes is a change in temperature, and since cold is capable of producing phenomena of the blood identical with those produced by high altitude, it would appear that cold is an important factor in accounting for the blood changes due to high altitude. That cold is the only factor the writer does not maintain.

HENRY B. WARD,
Secretary.

THE GLASGOW MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE enterprise of the city of Glasgow in holding this year a large and successful industrial exposition attracted to that great commercial center a large number of congresses, and among others the British Association for the Advancement of Science, which held its sessions under the presi-

dency of Professor Arthur W. Rücker in the university building during the week beginning September 11. In attendance the meeting was not quite so successful as in previous years, the total number of members registered being 1,912. The following Americans had the honor of attending as guests of the Association: Chancellor MacCracken of the University of New York, Mr. Edward Atkinson of Boston, Professor Arthur Michael of Tufts College, Professor Edward W. Morley of Cleveland, Professor A. Lawrence Rotch of the Blue Hill Observatory and Professor J. Playfair McMurrich of the University of Michigan. The papers presented to the meeting reached the usual standard of excellence, and reports of the proceedings of the various sections will appear in later numbers of SCIENCE.

The usual public lectures were given by Professor W. Ramsay, on 'The Inert Constituents of the Atmosphere,' and by Mr. Francis Darwin on 'The Movements of Plants.' As is customary, numerous receptions were held in honor of the Association, and the majority of the members took advantage of the suspension of meetings of the sections, on the Saturday, to make excursions to various points of interest in the western Highlands or to visit some of the numerous great industrial enterprises which have made Glasgow famous.

THE GEOLOGICAL SECTION.

As might have been expected from the place of meeting of the Association, much of the material presented to the Geological Section dealt with the geology of Scotland. The president of the section, Mr. John Horne, acting director of the Geological Survey of Scotland, gave as his address a review of the progress in our knowledge of Scottish geology during the quarter-century which has elapsed since the last meeting of the Association in Glasgow, and furnished such abundant evidence of the activity and skill of the Scotch geologists in recent years as to justify the hope which was expressed that their work might form a fitting sequel to the labors of such men as Hutton, Hall, Murchison, Lyell, Hugh Miller, Fleming, Nicol and Ramsay, all of whom claimed Scotland as the land of their birth. It would be difficult to satisfactorily abstract the address, since from the wealth of material with which it had to deal, it in itself was but an all too brief synopsis; but there may be mentioned, among the important additions to geology to which reference was made: the tabulation of the various divisions of the Torridonian sandstones by the Geological Survey and the determination of the pre-Cambrian age of that formation; the collection of evidence of post-Cambrian terrestrial movements in the northwest Highlands resulting in the production of reversed faults and thrusts for which a parallel can be found only in the Alps and Provence, the determination of the order of succession of the Silurian rocks of the south of Scotland by Professor Lapworth, the unraveling of the history of the secondary rocks by Professor Judd; and the study of the Tertiary volcanic rocks of the western coast.

In connection with this last-named topic attention was called to the recent discovery, in the island of Arran, of a volcanic vent covering an area of about eight square miles and now filled with volcanic agglomerate and large masses of sedimentary material which has yielded Rhætic and Lower Triassic fossils. And in a special paper Sir Archibald Geikie described an interesting circumstance which gave a basis for estimating the time intervals between successive lava flows in the inner Hebrides. This was the occurrence in the basalt of the west coast of Mull of a fossil tree whose roots were apparently imbedded in a lower sheet of lava, in which were signs of soil. The

tree, which was penetrated by calcite, extended to about five feet above this old soil, and above this was a hollow in the basalt about forty feet high, which evidently represented a cast of the tree. The conditions indicated an old lava flow which had later undergone a certain amount of disintegration and afforded a soil upon which the tree established itself; then a period succeeded during which the tree grew until it reached a diameter of eight feet and an estimated height of eighty feet; then an outflow of lava around the tree was followed by an interval during which the decay of the tree took place; and finally the outflow of the sheet of basalt, which covered and sealed up the top of the hollow left by the decay.

The geology of the nearly related north coast of Ireland also received its due share of attention, papers being presented by Messrs. McHenry and Kilroe, of the Geological Survey, on 'The Relations of the Old Red Sandstones of Northwest Ireland to the Adjacent Metamorphic Rocks and their Similarity to the Torridon Beds of Sutherland,' and on 'The Relation of the Silurian and Ordovician Rocks of Northwest Ireland to the Great Metamorphic Series.' This latter paper, which attempted to refer the metamorphic rocks of Mayo and Galway to the Lower Silurian period, awakened a considerable amount of discussion and some adverse criticism, since, if the views of the authors were correct, it became a difficult matter to explain the present difference between these rocks and the fossil-bearing Lower Silurian beds of adjoining areas. Papers were also read by Mr. G. H. Kinahan, entitled, 'Notes on the Irish Primary Rocks and their Associated Granite and Metamorphic Rocks,' and on 'Some Laccolites in the Irish Hills.'

Papers on the geology of foreign areas were comparatively few. Miss Raisin gave an account of a lithological study of volcanic rocks collected on Perim Island and took occasion to refer to the geological history of the Red Sea area, inferring that this sea formed part of the Great Rift Valley, extending from Lake Tanganyika to the Jordan and displaying at many places volcanic outbursts on a large scale, at different periods. Dr. Logan Jack, formerly head of the Geological Survey of Queensland, gave an account of the 'Artesian Water in the State of Queensland.' The greater part of the western interior of Queensland is composed of soft beds of lower Cretaceous rocks so disposed as to crop out on the western flanks of the coast range where the elevation and rainfall are greater than in the downs of the west. Along the eastern margin of the Cretaceous outcrop is a porous sandstone whose outcrop forms a belt of from five to twenty-five miles in width, the strata dipping at a low angle beneath the clayey and calcareous beds which form the surface of the downs. The conditions accordingly seemed favorable for boring artesian wells, and a successful beginning of the development of a water supply of this nature was made under the supervision of Dr. Jack in 1885 and up to June, 1900, one hundred and eighty-five miles of boring had been made in the district, the majority of the borings being successful. Owing, however, to the fact that the artesian basins are imperfect, a considerable amount of leakage takes place from them, the water probably finding an outlet into the Great Australian Bight or the Gulf of Carpentaria.

In a paper on 'The Physical History of the Norwegian Fiords,' Professor Edward Hull described six important stages in the development of these characteristic features of the Norwegian coast. First there was the continental condition with archæan rocks; when the river erosion began, and this was succeeded by a second stage of partial submergence in early Silurian times. The third stage was the elevation of the land

during Mesozoic and Tertiary periods, accompanied by a deepening of the river channels; the fourth was the early glacial period, during which the elevation reached its greatest development. The fifth period was the post-glacial, characterized by subsidence and partial submergence of the land; and the sixth and recent stage was a stage of reëlevation to the present conditions, the process being accompanied by the formation of raised beaches.

On the mineralogical side papers were read on 'The Copper-bearing Rocks of South Australia,' by Mr. E. P. Manuell; on 'Scottish Ores of Copper in their Geological Relation,' by Mr. J. G. Goodchild; on 'The Occurrence of Barium Sulphate and Calcium Fluoride as Cementing Substances in the Elgin Trias,' by Dr. W. Mackie; and on 'The Source of the Alluvial Gold of the Kildonan Field, Sutherland,' by Mr. Malcolm Maclaren, who took occasion to advocate a return in certain cases to the old theory of the precipitation of gold from solution by carbonaceous matters, a theory which has been almost forgotten since Skey's demonstration of the power possessed by sulphides to produce complete precipitation.

Of paleontological papers there may be mentioned that by Professor Smith Woodward on 'The Bone Beds of Pikermi, Attica, and on Similar Deposits in Northern Eubœa,' giving an account of the excavations made by the trustees of the British Museum at the suggestion of Sir E. H. Egerton, British Minister at Athens. These researches have added but little to the list of forms already known to occur in the beds, though much important material was obtained, and excavations at Achmet Aga, northern Eubœa, revealed bone beds similar to those of Pikermi and containing similar fossils. The most plausible explanation of these bone deposits seems to be that the bodies of animals were carried by torrential floods through tree-obstructed water courses to lakes in which they collected, the broken limbs and torn fragments of trunks affording evidence of the violence of the passage to the lakes. Mr. J. L. Beadnell of the Geological Survey of Egypt gave a preliminary notice of the discovery of a rich deposit of new Pliocene and post-Pliocene fossils in the Fayum depression, situated in the Libyan desert some fifty miles southwest of Cairo, and Mr. B. N. Peach presented a contribution to the Cambrian fossils of the northwest Highlands, in which he pointed out that the fossils in the Balnakiel group of the Durness dolomities present a remarkable American facies and suggested the existence in Cambrian times of a large continent extending from the north of Scotland to America, an idea which, as was pointed out by Professor Lapworth, was supported by the fact that the succession of beds in northern Scotland was paralleled only on the American continent.

Professor Sollas described a method by which serial sections, similar to those employed by zoologists, might be made of fossils, and exhibited a machine designed for the purpose by the Rev. G. Smith and also showed wax models reconstructed from serial sections of a Graptolite, of an Ophiuran and of *Palæospondylus*.

Finally reference may be made to a suggestive paper by Mr. J. R. Kilroe on 'Geology regarded in its Economic Application to Agriculture by means of Soil Maps,' in which he claimed that the geologist could furnish much information regarding the profitable localization of certain branches of agriculture, such as stock-breeding, dairying and tillage, and advocated the publication of maps which would give information as to the nature of the soil in different localities. The author believed that much of practical value could be done by the geologists even without an extensive

set of soil analyses, and described a scheme of coloration which might be employed to indicate different qualities of soil.

THE ZOOLOGICAL SECTION.

The address of the President of the zoological section, Professor J. Cossar Ewart, was entitled, 'The Experimental Study of Variation,' and was a consideration of the results of experimental breeding in their bearing on the causes of variation and on certain theories which have been more or less generally accepted. Especial interest was given to the address by the fact that the conclusions reached were based for the most part on the results of experiments conducted by the author at his Penycuik station, and the members of the association had the pleasure of studying for themselves three of the now celebrated zebra hybrids which Professor Ewart has bred.

In opening his address Professor Ewart assumed that the primary cause of variation is always the effect of external influences acting directly upon the germ-cells and proceeded to discuss certain influences which might be supposed to be active in the production of variability.

1. Age was found to have a decided effect upon the character of the offspring. A young blue-rock male pigeon was mated with a well-matured and vigorous black barb; the first pair of birds resulting from the mating were almost exactly like the female parent except that the beaks were rather longer; one of the second brood resembled the barb, while the other was of a grayish color with slightly mottled wings and a tail bar; in the third brood both birds were of a grayish color with indistinct wing bars as well as a tail bar; while in the fourth brood one bird resembled the birds of the third brood, while the other resembled closely its blue rock sire. Similar results were obtained by mating a young blue rock male with a white fantail, and also by pairing young gray quarter-wild rabbits with an old white Angora buck, and Professor Ewart regards the gradual, 'almost mathematical' change in the coloration of the offspring as due to the gradual increase of vigor or prepotency of the young sires. The phenomena might possibly be explained by the doctrine of 'saturation' popular among breeders, but such an explanation is overthrown by the occurrence of the same results in the crossing of young females with old males.

2. Ripeness of the germ-cells. In studying the effect of this condition the Penycuick experiments confirmed the results obtained by Mr. H. M. Vernon from the hybridization of Echinoderm ova, 'the offspring resulting from the union of equally ripe germ-cells differing from the offspring developed from the conjugation of ripe and unripe germ-cells, and still more from the union of fresh and over-ripe germ-cells.'

3. The condition of the soma. Undoubtedly the germ-cells may be influenced by a diminution of the vitality of the soma, but there is no evidence to show that they are modified in such a way as to transmit definite modifications in the offspring.

4. Change of habitat. This factor acts by influencing the vigor of the soma, but 'there is no evidence whatever that definite changes of the soma, due to the direct action of the environment, can be imprinted on the germ-cells.'

5. Intercrossing and interbreeding. Intercrossing in general tends towards reversion and never results in the production of characters absolutely new to the species. It may, however, indirectly tend towards progressive variation by imparting additional vigor to the offspring, which when intercrossed frequently give rise to 'an almost infinite diversity of character.' Interbreeding, on the other hand, may be a cause of progressive variation. Vigor, however, plays a very important part in the de-

termination of the characters of the offspring and if interbreeding be performed with animals lacking in vigor or with too closely related individuals, it leads to what may be termed degeneration, the offspring being frequently delicate, of impaired fertility and, what is remarkable, frequently either entirely or nearly white.

In connection with the question of intercrossing Professor Ewart considered the swamping effect upon new varieties, pointing out how important the decision of this point is upon the validity of the doctrine of natural selection. Darwin himself nowhere suggests how new varieties escape swamping, although Wagner by his theory of isolation, and Romanes by that of physiological selection, have indicated special methods by which it may be avoided. It seems certain, however, that new varieties make their appearance even in the absence of such barriers to intercrossing, and Professor Ewart points out that it does not seem to have occurred to biologists that a new variety may be sufficiently vigorous or prepotent to swamp the old, since it is unquestionable that the vigor of the parents has much to do with the character of the offspring. Professor Ewart possesses a skewbald Iceland pony which produces richly striped hybrids to a zebra, but to whole-colored bay, Arab, or Shetland ponies invariably gives offspring colored exactly like herself. So too, black Galloway bulls frequently produce, through long-horned, brightly colored Highland heifers, offspring which would readily pass for pure Galloways, and it is known that the wolf is prepotent over the dog and the wild rabbit, rat and mouse over their tame relatives. Granting, therefore, a variety more vigorous than the ancestral form, intercrossing, instead of swamping it, would only increase the number of individuals representing it, even without any such barriers as are demanded by the theories of Wagner and Romanes.

6. Maternal impressions. There is no evidence to show that such impressions affect in any way the offspring.

7. Needs of the organism.

8. Direct action of the environment and use-inheritance. Neither of these causes is believed by Professor Ewart to have any action in the production of definite variations.

9. Telegony or infection. Referring to the celebrated case of supposed telegony described by Lord Morton, the author produced evidence showing that the observed case was more probably due to reversion than to infection, and furthermore he added to his original observations on the subject by stating that since 1895 twelve mares, after producing sixteen zebra hybrids, have given birth to twenty-two pure-bred foals, in none of which is there any indication of the action of telegony. It was also pointed out that the observations of Baron de Parana in Brazil upon the pure-bred offspring of mares previously mated with zebras, as well as his results obtained from several mule-breeding establishments which are in reality carrying on telegony experiments on a large scale, were entirely negative.

The address concluded with a brief appeal for the establishment of a well-equipped institute for biological experimentation on a large scale.

The address of the President was followed by the report of the special committees appointed at the last meeting of the Association. That on bird migration in Great Britain dealt with the migration of larks and swallows, while progress was reported by the committee on the Index Animalium, the Natural History and Ethnography of the Malay Peninsula, the coral reefs of the Indian regions and the Zoology of the Sandwich Islands.

Of the special papers presented it must suffice to mention but a few. Mr. J. Stan-

ley Gardiner gave an account, illustrated by excellent lantern slides, of his observations upon the coral islands of the Maldives, the evidence obtained seeming to indicate that they had been formed during a period of elevation. Dr. J. Y. Simpson gave the results of his observations on the occurrence of variation in binary fission. It has been generally accepted that this method of reproduction is merely a duplication and that variation does not occur in connection with it, but only as the result of a commingling of the chromatin of two individuals in conjugation. Testing this generalization by observation of successive generations of *Paramœcium* and *Stylonychia*, it was found that variation may accompany fission, modifications occurring in the general outline of the body, in its total length, in its greatest breadth, in the distance between the contractile vacuoles of *Paramœcium* and in the length of the median caudal bristle of *Stylonychia*. From the fact that such variations do occur and may be transmitted to the succeeding generation, it would seem that fission is the primary method of reproduction among the Ciliate Infusoria, and that conjugation is merely a method of compensating for the waste involved in that process.

The President of the Section gave some observations, additional to those contained in his address and illustrated by lantern slides, on zebras and zebra-hybrids. He pointed out that the stripes of the zebra were undoubtedly protective, causing the animal to become indistinguishable at a comparatively short distance, and he was able to render a dun-colored pony similarly indistinguishable by tying ribbons upon it so as to break up the uniform coloration. The lion is the most inveterate enemy of the zebra, which is protected by its coloration as well as by the rapidity of its movements, for there is no animal which the author knew which could turn about and break into a trot so quickly as the zebra. As to the original nature of the coloration of the zebra, it was pointed out that although the forms such as the Chapman zebra, which were less striped, might be supposed to be most primitive, yet it was an interesting fact that zebra-donkey hybrids were more richly striped than pure-bred zebras.

Professor W. E. Hoyle described an interesting sub-pallial luminous organ in certain forms of Cephalopods, and Mr. J. Graham Kerr read a suggestive paper on the 'Origin of the Limbs of Vertebrates,' in which, after pointing out the unsatisfactory nature of the theories at present existent, he suggested the possibility of the limbs being derived for external branchiæ, such as are found in *Polypterus* and in certain Urodele amphibians. It may be stated, however, that from the discussion which followed, the new suggestion did not seem to be received with any great amount of favor. Major Ronald Ross gave an account of the experiments on the destruction of the mosquito now being carried on in Sierra Leone by the Liverpool School of Tropical Medicine, and stated that although the experiments had been in progress now for only two or three months, yet there was already an appreciable diminution in the numbers of the insects, and maintained that it is possible that even on the west coast of Africa, malaria may become a thing of the past.

Other papers presented to the Section were 'The Pelvic Cavity of the Porpoise as a Guide to the Determination of the Sacral Region in the Cetacea,' by Drs. Hepburn and Watson; 'The Relationship of the Premaxilla in Bears,' by Professor R. J. Anderson; 'A Method of Recording Local Faunas,' by Mr. E. J. Bles; 'The Fishes of the Coats Arctic Expedition,' and 'A Preliminary Notice of the Fauna of Franz Joseph Land,' by Mr. W. S. Bruce; 'The Behavior of Artifi-

cially Hatched Gulls,' and 'On Germinal Selection in Relation to Inheritance,' by Professor J. Arthur Thompson; 'The Tanganyika Problem,' by Mr. J. E. S. Moore; 'The Mechanism of the Frog's Tongue,' by Professor Marcus Hartog and Mr. Nevil Maskeleyne; 'Dimorphism in the Foraminifera,' by Mr. J. J. Lister; 'The Habits and Life Histories of some Sarawak Insects,' by Mr. R. Shelford; 'On a Large Nematode Parasite in the Sea-urchin,' by Dr. J. F. Gemmill; 'On the Youngest Known Larva of Polypterus,' by Mr. J. S. Budgett; on 'The Land Crabs of a Coral Island,' by Mr. L. A. Borradaile; and on 'The Fauna of an Atoll,' by Mr. C. F. Cooper.

A very pleasing incident of the meeting was the announcement of a generous gift, amounting to £3,500, from a donor who wished to remain anonymous, towards the equipment of the Scottish Marine Biological Station, now established at Millport on Cumbrae Island in the Firth of Clyde. The station, which was visited by a large number of the members of the Section, is admirably situated and is accomplishing most excellent work. The present gift will be devoted to an extension of the buildings so as to afford quarters for those who may be working at the station.

J. Playfair McMurrich.
University of Michigan.

Address of the President of the Anthropological Section of the British Association, II.

The insular district in the fetal brain is a depressed area of an elongated triangular form. The general surface of the cerebrum occupies, all round about it, a more elevated plane, and thus the insula comes to be bounded by distinct walls, like the sides of a shallow pit dug out in the ground. The upper wall is formed by the lower margins of the frontal and parietal lobes, the lower wall by the upper margin of the temporal lobe, and the front wall by the frontal lobe. From each of these bounding walls a separate portion of cerebral cortex grows, and these gradually creep over the surface of the insula so as to overlap it, and eventually completely cover it over and exclude it from the surface, in the same way that the lips overlap the teeth and gums. That which grows from above is called the *fronto-parietal operculum*, while that which grows from below is termed the *temporal operculum*. These appear very early, and are responsible for closing over more than the hinder three-fourths of the insula. The lower or temporal operculum is in the first instance more rapid in its growth than the upper or fronto-parietal operculum, and thus it comes about that when their margins meet more of the insula is covered by the former than by the latter. So far the development is apparently precisely similar to what occurs in the ape. The slit or fissure formed by the approximation of the margins of these two opercula is called the Sylvian fissure, and it constitutes a natural lower boundary for the parietal and frontal lobes which lie above it. At first, from the more energetic growth of the lower temporal operculum, this fissure slants very obliquely upward and backward, and is very similar in direction to the corresponding fissure in the brain of the ape. But in the human brain this condition is only temporary. Now begins that downward movement of the parietal lobe and back part of the frontal lobe to which reference has been made. The upper or fronto-parietal operculum, in the later stages of fetal life and the earlier months of infancy, enters into a growth antagonism with the lower or temporal operculum, and in this it proves the victor. The margins of the two opercula are tightly pressed together, and, slowly but surely, the fronto-parietal operculum gains ground, pressing down the temporal operculum, and thus extending

the territory of the frontal and parietal districts. This is a striking process in the brain development of man, and it results in a depression of the Sylvian fissure or the lower frontier line of the frontal and parietal lobes. Further, to judge from the oblique direction of the Sylvian fissure in the brain of the ape, the process is peculiar to man; in the simian brain there is no corresponding increase in the area of cerebral cortex under consideration.

I do not think that it is difficult to account for this important expansion of the cerebral surface. In the fore part of the region involved are placed the groups of motor centers which control the muscular movements of the more important parts of the body. These occupy a broad strip of the surface which stretches across the whole depth of the district concerned. Within this are the centers for the arm and hand, for the face, the mouth and the throat, and likewise, to some extent, the center for speech. In man certain of these have undoubtedly undergone marked expansion. The skilled movements of the hands, as shown in the use of tools, in writing, and so on, have not been acquired without an increase in the brain mechanism by which these are guided. So important, indeed, is the part played by the human hand as an agent of the mind, and so perfectly is it adjusted with reference to this office, that there are many who think that the first great start which man obtained on the path which has led to his higher development was given by the setting of the upper limb free from the duty of acting as an organ of support and locomotion. It is an old saying 'that man is the wisest of animals because of his hands.' Without endorsing to its full extent this view, I think that it cannot be a matter for surprise that the district of the cerebral cortex in man in which the arm-centers reside shows a manifest increase in its extent.

In the same region of cerebral cortex, but at a lower level, there are also situated the centers which are responsible for facial expression. In the ape there is a considerable degree of facial play; but this is chiefly confined to the region of the lips, and the muscles of the face, although present in greater mass, show comparatively little of the differentiation which is characteristic of the lighter and more feeble muscles in the face of man. And then as to the effect produced: These human muscles are capable of reflecting every fleeting emotion, every change of mind, and, by the lines and furrows their constant use indelibly fixes on the countenance, the character and disposition of an individual can to some extent be read. As the power of communication between primitive men became gradually established, facial movements were no doubt largely used, not only for the purpose of giving expression to simple emotions, such as anger or joy, but also for giving point and force to the faltering speech of our early progenitors by reflecting other conditions of mind. The acquisition of this power as well as the higher and more varied powers of vocalization must necessarily have been accompanied by an increase of cerebral cortex in the region under consideration. And in this connection it is a point well worthy of note that the area of cortex mapped out in the human brain,* as controlling the muscles of the face, mouth and throat, is as large if not larger than that allotted to the arm and hand,† and yet it is questionable if all the

*See diagram in Schäfer's article on the 'Cerebral Cortex' in his recent work on physiology.

† The comparison only refers to surface area, and this is not an absolutely true criterion of the relative amount of cortex in each region. The arm-center has a large amount of cortex stowed away within the fissure of Rolando, in the shape of interlocking gyri, which is not taken into account in a measurement confined to the superficial surface area. Still, this does not to any great degree detract from the argument which follows, seeing that the discrepancy is still sufficiently marked.

muscles under the sway of the former would weigh as much as one of the larger muscles (say the triceps) of the arm. This is sufficient to show that it is not muscle power which determines the extent of the motor areas in the cerebral cortex. It is the degree of refinement in the movements required, as well as the degree of variety in muscle combinations, which apparently determines the amount of ground covered by a motor center.

Still, the increase in the amount of cerebral cortex in man due to the greater refinement of movement acquired by different groups of muscles is relatively small in comparison with the increase which has occurred in other regions from which no motor fibers are sent out, and which therefore have no direct connection with muscles.

The remarkable conclusions arrived at by Flechsig, although not confirmed and accepted in all their details, have tended greatly to clear up much that was obscure in the relations of the different districts of cerebral cortex. More particularly has he been able to apportion out more accurately the different values to be attached to the several areas of the cerebral surface. He has shown that fully two thirds of the cortex in the human brain constitutes what he terms 'association centers.' Within these the higher intellectual manifestations of the brain have their origin, and judgment and memory have their seat. They are therefore to be regarded as the psychic centers of the cerebral cortex.

Now, it requires a very slight acquaintance with the cerebral surface to perceive that the great and leading peculiarity of the human brain is the wide extent of these higher association centers of Flechsig. Except in connection with new faculties, such as speech, there has been relatively no striking increase in the extent of the motor areas in man as compared with the cortex of the ape or the idiot, but the expansion of the association areas is enormous, and the increase in the frontal region and the back part of the parietal region is particularly well marked. It is this parietal extension of surface which is chiefly responsible for the pushing down of the lower frontier of the parietal lobe and the consequent enlargement of its territory.

I have already referred to the views which have been recently urged by several independent observers, that in the men who have been distinguished during life by the possession of exceptional intellectual power this region has shown a very special development.

It is a curious circumstance, and one which is worthy of consideration, that in the left cerebral hemisphere the Sylvian fissure or the lower boundary of the parietal lobe is more depressed than in the right hemisphere, and, as a result of this, the surface area occupied by the parietal lobe is greater on the left side of the brain than on the right side. To the physiologist it is a matter of every-day knowledge that the left cerebral hemisphere shows in certain directions a marked functional preeminence. Through it the movements of the right arm and right side of the body are controlled and regulated. Within it is situated also the active speech center. This does not imply that there is no speech center on the right side, but simply that the left cerebral hemisphere has usurped the chief, if not the entire, control of this all important function, and that from it are sent out the chief part, if not the whole, of the motor incitations which give rise to speech. The significance attached to the dominant power of the left hemisphere receives force from the now well-established fact that in left-handed individuals the speech function is also transferred over to the right side of the brain. To account for this functional preeminence of the left cerebral hemisphere numerous theories have been elaborated. The inter-

est attached to the subject is very considerable, but it is impossible on the present occasion to do more than indicate in the briefest manner the three views which have apparently had the widest influence in shaping opinion on this question. They are: (1) That the superiority of the left cerebral hemisphere is due to its greater weight and bulk; (2) that it may be accounted for by the greater complexity of the convolutions on the left brain and the fact that these make their appearance earlier on the left side than on the right side; (3) that the explanation lies in the fact that the left side of the brain enjoys greater advantages in regard to its blood supply than the right side.

Not one of these theories when closely looked into is found to possess the smallest degree of value. Braune* has shown in the most conclusive manner that if there is any difference in weight between the two hemispheres it is a difference in favor of the right and not of the left hemisphere; and I may add from my own observations that this is evident at all periods of growth and development. Equally untrustworthy are the views that have been put forward as to the superiority of the left hemisphere from the point of view of convolutionary development. I am aware that it is stated that in two or three cases where the brains of left-handed people have been examined this superiority was evident on the right hemisphere. This may have been so; I can only speak for the large percentage of those who are right-handed; and I have never been able to satisfy myself that either in the growing or fully developed brain is there any constant or marked superiority in this respect of the one side over the other; and I can corroborate Ecker† in his statement that there is no proof that the convolutions appear earlier on the one side than on the other. The theory that an explanation is to be found in a more generous blood supply to the left hemisphere is more difficult to combat, because the amount of blood received by each side of the brain depends upon two factors, viz., the physical conditions under which the blood-stream is delivered to the two hemispheres and the caliber of the arteries or tubes of supply. Both of these conditions have been stated to be favorable to the left hemisphere. It is a matter of common anatomical knowledge that the supply pipes to the two sides of the brain are laid down somewhat differently, and that the angles of junction, etc., with the main pipe are not quite the same. Further, it is true that the blood-drains which lead away the blood from the brain are somewhat different on the two sides. Whether this would entail any marked difference in the blood-pressure on the two sides I am not prepared to say. This could only be proved experimentally; but, taking all the conditions into consideration, I am not inclined to attach much importance to the argument. It is easy to deal with the loose statements which have been made in regard to the size of leading supply pipe (viz., the internal carotid artery). It passes through a bony canal on the floor of the cranium on its way into the interior of the cranial box. Its size can therefore be accurately gauged by measuring the sectional area of this bony tunnel on each side. This I have done in twenty-three skulls chosen at random, and the result shows that considerable differences in this respect are to be found in different skulls. These discrepancies, however, are sometimes in favor of the one side and at other times in favor of the other side, and when the combined sectional area for all the skulls examined was calculated, it was, curiously enough, found to be 583½ sq. mm. for the left side and 583 sq. mm. for the right side.

* 'Das Gewichtsverhältniss der rechten zur linken Hirnhälfte beim Menschen,' *Archiv für Anat.*

† *Archiv für Anthropologie*, 1868, Bd. CXI.

Leaving out of count the asymmetry in the arrangement of the convolutions in the two hemispheres, which cannot by any amount of ingenuity be twisted into such a form as to give a structural superiority to one side more than the other, the only marked difference which appears to possess any degree of constancy is the increase in the territory of the left parietal lobe produced by the more marked depression of its lower frontier line (Sylvian fissure). That this is in any way associated with right-handedness or with the localization of the active speech center in the left hemisphere I am not prepared to urge, because the same condition is present in the ape. It is true that some authorities* hold that the ape is right-handed as well as man, but in the gardens of the Royal Zoological Society of Ireland I have had a long and intimate experience of both anthropoid and lower apes, and I have never been able to satisfy myself that they show any decided preference for the use of one arm more than the other.

That differences do exist in the more intimate structural details of the two hemispheres, which give to the left its functional superiority, there cannot be a doubt; but these have still to be discovered. Bastian has stated that the gray cortex on the left side has a higher specific gravity, but this statement has not as yet received corroboration at the hands of other observers.

I have already mentioned that man's special endowment, the faculty of speech, is associated with striking changes in that part of the cerebral surface in which the motor center for articulate speech is located. It is questionable whether the acquisition of any other system of associated muscular movements has been accompanied by a more evident cortical change. The center in question is placed in the lower and back part of the frontal lobe. We have seen that the insular district is covered over in the hinder three-fourths of its extent by the fronto-parietal and temporal opercula, and thus submerged below the surface and hidden from view. The brain of the ape and also of the microcephalic idiot with defective speech goes no further in its development. The front part of the insular district remains uncovered and exposed to view on the surface of the cerebrum. In man, however, two additional opercula grow out and ultimately cover over the fore part of the insula. These opercula belong to the lower and back part of the frontal lobe, and are to be looked upon as being more or less directly called into evidence in connection with the acquisition of articulate speech.

The active speech center is placed in the left cerebral hemisphere. We speak from the left side of the brain, and yet when the corresponding region* on the right side is examined it is found to go through the same developmental steps.

The stimulus which must have been given to general cerebral growth in the association areas by the gradual acquisition of speech can hardly be exaggerated.

During the whole course of his evolution there is no possession which man has contrived to acquire which has exercised a stronger influence on his higher development than the power of articulate speech. This priceless gift, 'the most human manifestation of humanity' (Huxley), was not obtained through the exertions of any one individual or group of individuals. It is the result of a slow process of natural growth, and there is no race, no matter how

* Ogle, 'On Dextral Preeminence,' *Trans. Med. Chirurg. Soc.*, 1871; Aimé Père, 'Les Courbures latérales normales au rachis humain,' Toulouse, 1900.

* Rudinger and others have tried on very unsubstantial grounds to prove that there is a difference in this region on the two sides of the brain. There is, of course, as a rule, marked asymmetry; but I do not think that it can be said with truth that the cortical development of the region is greater on the left side than on the right.

low, savage or uncultured, which does not possess the power of communicating its ideas by means of speech. "If in the present state of the world," says Charma, "some philosopher were to wonder how man ever began to build those houses, palaces, and vessels which we see around us, we should answer that these were not the things that man began with. The savage who first tied the branches of shrubs to make himself a shelter was not an architect, and he who first floated on the trunk of a tree was not the creator of navigation." And so it is with speech. Rude and imperfect in its beginnings, it has gradually been elaborated by the successive generations that have practiced it.

The manner in which the faculty of speech originally assumed shape in the early progenitors of man has been much discussed by philologists and psychologists, and there is little agreement on the subject. It is obvious that all the more intelligent animals share with man the power of giving expression to certain of the simpler conditions of mind both by vocal sounds and by bodily gestures. These vocal sounds are of the interjectional order, and are expressive of emotions or sensations. Thus the dog is said, as a result of its domestication, to have acquired the power of emitting four or five different tones, each indicative of a special mental condition and each fully understood by its companions. The common barn-door fowl has also been credited with from nine to twelve distinct vocal sounds, each of which is capable of a special interpretation by its fellows or its chickens. The gestures employed by the lower animals may in certain cases be facial, as expressed by the grimaces of a monkey, or changes in bodily attitude, as we see continually in the dog.

I think that it may not be unreasonably inferred that in the distant past the remote progenitors of man relied upon equally lowly means of communicating with their fellows, and that it was from such humble beginnings that speech has been slowly evolved.

There cannot be a doubt that this method of communicating by vocal sounds, facial expressions and bodily gestures is capable of much elaboration; and, further, it is possible, as some hold, that it may have attained a considerable degree of perfection before articulate speech began to take form and gradually replace it. Much of it indeed remains with us to the present day. A shrug of the shoulders may be more eloquent than the most carefully prepared phrase; an appropriate expression of face, accompanied by a suitable ejaculation, may be more withering than a flood of invective. Captain Burton tells us of a tribe of North American Indians whose vocabulary is so scanty that they can hardly carry on a conversation in the dark. This and other facts have led Mr. Tylor, to whom we owe so much in connection with the early history of man, to remark: "The array of evidence in favor of the existence of tribes whose language is incomplete without the help of gesture-signs, even for things of ordinary import, is very remarkable"; and, further, "that this constitutes a telling argument in favor of the theory that gesture-language is the original utterance of mankind out of which speech has developed itself more or less fully among different tribes." It is a significant fact also, as the same author points out, that gesture-language is, to a large extent, the same all the world over.

Many of the words employed in early speech were undoubtedly formed, in the first instance, through the tendency of man to imitate the natural sounds he heard around him. To these sounds, with various modifications, was assigned a special conventional value, and they were then added to the growing vocabulary. By this means a very decided forward step was taken, and

now primitive man became capable of giving utterance to his perceptions by imitative sounds.

Max Müller, although bitterly opposed to the line of thought adopted by the 'Imitative School' of philologists, has expressed their views so well that I am tempted to use the words he employed in explaining what he satirically branded as the 'Bow-wow Theory.' He says: "It is supposed that man, being yet mute, heard the voices of the birds, dogs and cows, the roaring of the sea, the rustling of the forest, the murmur of the brook and the whisper of the breeze. He tried to imitate these sounds, and finding his mimicking cries useful as signs of the object from which they proceeded, he followed up the idea and elaborated language."

Hood* humorously and unconsciously illustrates this doctrine by a verse descriptive of an Englishman, ignorant of French, endeavoring to obtain a meal in France:

> 'Moo!' I cried for milk;
> If I wanted bread
> My jaws I set agoing;
> And asked for new-laid eggs
> By clapping hands and crowing.

But, although much of early articulate speech may have arisen by the development of interjectional sounds and the reproduction, by the human vocal organs, of natural sounds, it is very unlikely that these afforded the only sources from which words were originally derived. Romanes insists upon this, and, in support of his argument, refers to cases where children invent a language in which apparently imitative sounds take no part. He likewise alludes to the well-known fact that deaf mutes occasionally devise definite sounds which stand for the names of friends. In the light of such evidence, he very properly asks, 'Why should it be held impossible for primitive man to have done the same?'

* Quoted from 'The Origin of Language,' by Hensleigh Wedgwood, 1866.

The value of spoken language as an instrument of thought is universally admitted, and it is a matter incapable of contradiction that the higher intellectual efforts of man would be absolutely impossible were it not for the support which is afforded by articulate speech. Darwin expresses this well when he says: "A complex train of thought can no more be carried on without the aid of words, whether spoken or silent, than a long calculation without the use of figures or symbols." Such being the case, I think that we may conclude that the acquisition of speech has been a dominant factor in determining the high development of the human brain. Speech and mental activity go hand in hand. The one has reacted on the other. The mental effort required for the coining of a new word has been immediately followed by an increased possibility of further intellectual achievement through the additional range given to the mental powers by the enlarged vocabulary. The two processes, mutually supporting each other and leading to progress in the two directions, have unquestionably yielded the chief stimulus to brain development.

More than one philologist has insisted that 'language begins where interjection ends.' For my part, I would say that the first word uttered expressive of an external object marked a new era in the history of our early progenitors. At this point the simian or brute-like stage in their developmental career came to an end and the human dynasty endowed with all its intellectual possibilities began. This is no new thought. Romanes clearly states that in the absence of articulation he considers it improbable that man would have made much psychological advance upon the anthropoid ape, and in another place he remarks that 'a manlike creature became human by the power of speech.'

The period in the evolution of man at which this important step was taken is a

vexed question, and one in the solution of which we have little solid ground to go upon beyond the material changes produced in the brain and the consideration of the time that these might reasonably be supposed to take in their development.

Darwin was inclined to believe that articulate speech came at an early period in the history of the stem-form of man. Romanes gives a realistic picture of an individual decidedly superior to the anthropoid ape, but distinctly below the existing savages. This hypothetical form, half simian, half human, was, according to his sponsor, probably erect; he had arrived at the power of shaping flints as tools, and was a great adept at communicating with his fellows by gesture, vocal tones and facial grimaces.

With this accomplished ancestor in his mental eye, it is not surprising that Romanes was inclined to consider that articulate speech may have come at a later period than is generally supposed.

At the time that Romanes gave expression to these views he was not acquainted with the very marked structural peculiarities which distinguish the human brain in the region of the speech center. I do not refer to the development of the brain in other districts, because possibly Romanes might have held that the numerous accomplishments of his speechless ancestor might be sufficient to account for this; I merely allude to changes which may reasonably be held to have taken place in direct connection with the gradual acquisition of speech.

These structural characters constitute one of the leading peculiarities of the human cerebral cortex, and are totally absent in the brain of the anthropoid ape and of the speechless microcephalic idiot.

Further, it is significant that in certain anthropoid brains a slight advance in the same direction may occasionally be faintly traced, whilst in certain human brains a distinct backward step is sometimes noticeable. The path which has led to this special development is thus in some measure delineated.

It is certain that these structural additions to the human brain are no recent acquisition by the stem-form of man, but are the result of a slow evolutionary growth—a growth which has been stimulated by the laborious efforts of countless generations to arrive at the perfect coordination of all the muscular factors which are called into play in the production of articulate speech.

Assuming that the acquisition of speech has afforded the chief stimulus to the general development of the brain, and thereby giving it a rank high above any other factor which has operated in the evolution of man, it would be wrong to lose sight of the fact that the first step in this upward movement must have been taken by the brain itself. Some cerebral variation—probably trifling and insignificant at the start, and yet pregnant with the most far-reaching possibilities—has in the stem-form of man contributed that condition which has rendered speech possible. This variation, strengthened and fostered by natural selection, has in the end led to the great double result of a large brain with wide and extensive association areas and articulate speech, the two results being brought about by the mutual reaction of the one process upon the other.

D. J. CUNNINGHAM.

PROFESSOR PAWLOW'S RESEARCHES ON THE PHYSIOLOGY OF SECRETION.

THE publication, last year, of the conditions which are to govern the award of the Nobel prizes was followed not long since by the announcement that Professor J. P. Pawlow of St. Petersburg had been designated, with Professor Niels R. Finsen of Copenhagen, as the first recipient of this honor, for the most important discovery in

the department of physiology or of medicine. To those readers of SCIENCE who are not familiar with the details of modern physiological investigation, a brief review of the more important work of this brilliant Russian investigator may be of interest.

Professor Pawlow's researches have, for the most part, been directed to the solution of problems connected with the physiology of secretion. His persistent efforts in this field have been crowned with success to an unusual degree; and physiology owes to him and his coworkers much of the progress which has been made in recent years towards a clearer understanding of the processes of digestion in the animal organism. New experimental methods have been devised, and older ones applied to new purposes.

With reference to the nitrogenous metabolism of the salivary glands, Pawlow showed (1888) by direct chemical analysis, that anabolic and katabolic processes are coincident in the secreting organ. This observation, usually overlooked by physiologists, was in itself an important contribution to the theory of secretion. The extensive series of experiments on the innervation of the gastric and pancreatic glands—researches which have had their origin in Pawlow's laboratory—have evoked the widest attention. In this study of gastric secretion the improvements in the general technique consisted primarily in the simultaneous introduction of an ordinary gastric fistula (in dogs) and a division of the œsophagus in the middle of the neck. The cut ends were attached to openings in the neck so that swallowed food passed out at one opening without reaching the stomach; and, through the other, food which it was desired should enter the stomach could be passed in. The more important facts ascertained by the use of this method were, that when food is eaten a flow of gastric juice is started; inasmuch as under the experimental conditions referred to the ingested material fails to reach the stomach, the reflex character of the impulses which provoke the secretion can thus be demonstrated. The paths along which the reflex stimulation reaches the gastric glands were shown to be the vagus nerves; for while section of the splanchnics does not interfere with the reflex secretion, this reaction entirely disappears after division of the vagi. To make the proof complete, Pawlow showed that artificial stimulation of the peripheral end of a cut vagus will incite a flow of active gastric juice.

The possibility of obtaining pure gastric juice uncontaminated with the products of digestion was thus accomplished in a way never before equaled. It remained, however, to observe the production of the secretion and its properties during the course of actual digestion. Heidenhain had already developed a method of isolating one portion of the stomach from the rest, so that it was possible to keep animals in this condition under observation for a long period. In his operations, however, the nerve supply to the isolated portion was undoubtedly seriously interfered with. Pawlow improved the method, so that there remained an undisturbed nerve distribution, the functional importance of which he clearly showed. Secretion in the isolated portion could thus be followed while digestion was proceeding in the adjoining parts of the stomach.

Along similar lines our knowledge of the work of the pancreas and the production of the bile has been largely added to by Pawlow and his pupils. The introduction of a successful method for obtaining permanent fistulas has been followed by a study of the secretory activity of the pancreatic gland. The reflex character of the ordinary stimuli has been demonstrated, and the paths through which the impulses reach the gland ascertained. The existence of inhibitory

nerves for the secretory glands has been made more probable by Pawlow. The true significance of this discovery lies in the fact that it has enabled us to appreciate more clearly the mechanism by which the secretory glands, like other organs, adapt themselves so perfectly to the work which they have to accomplish at different times.

With pure digestive juices made thus readily available, it is not surprising to find interest in the study of their composition renewed. The way has been opened for more purely chemical investigations, such as the recent one of Professor v. Nencki—a colleague of Professor Pawlow—on the character of the enzymes of the gastric juice. From the general biological point of view, one of the most interesting aspects of the work of the St. Petersburg school is the demonstration of the purposeful character of secretion into the alimentary canal. Quantitatively and qualitatively the work of the glands varies with the character of the substances upon which they exert their action at different times. Changes in diet bring variations in the character of secretion. Pawlow has broadly expressed this view in summarizing his contributions to our knowledge of the specific excitability of the digestive glands. He writes: "Our results have, we trust, dispelled from our domain, once for all, the unfruitful idea that the alimentary canal is excitable by any agent whatsoever, mechanical, chemical or thermal, without regard to the peculiarity of each specific digestive task. At present, agencies such as these, vigorously applied, must be regarded merely as favoring or inhibitory influences, not as the normal and determining factors which excite secretory activity. In place of gross uncertainty (Scheinwissen) we now see the outlines of an artistic mechanism which, like everything that we understand in nature, exhibits an unusual degree of exactness and utility in her processes."

It remains to speak of Pawlow's work (in cooperation with v. Nencki and others) on the functions of the liver. Here again a brilliant operative technique—the Eck fistula, by which the portal blood is diverted directly into the vena cava without entering the hepatic capillaries—has inaugurated progress. The splendid researches on the seat of urea formation in mammals have modified and shaped the current teaching of this subject and other aspects of intermediary metabolism. What light they may throw upon the pathogeny of certain abnormal states, such as uræmia and diabetes, can scarcely be foretold.

Among the comparatively recent contributions to physiological literature no book has exerted a more stimulating influence than Pawlow's 'Die Arbeit der Verdauungsdrüsen' (J. F. Bergmann, Wiesbaden, 1898). It summarizes in suggestive chapters the main achievements of the author in his chosen field of work. Its original treatment of the problems in this domain has aroused the interest of both physiologists and physicians; and the work has already served in fulfilment of the author's hope, to further physiological science by promoting a more active interchange of ideas between the practitioner and the laboratory worker. Pawlow's work has demonstrated what Sir Michael Foster has written in another connection: that "the heart of physiology is in the laboratory. It is this which sends the life-blood through its frame; and in respect to this, perhaps, more than anything else, has the progress of the past years been striking."

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SCIENTIFIC BOOKS.

Report of the Sanitary Investigations of the Illinois River and its Tributaries. The Illinois State Board of Health, 1901.

The self-purification of streams has been for many years a perennial subject of discussion among sanitarians. Early faith in the power of running water to purify itself was severely shaken by the advent of the science of bacteriology, and the postulate that 'no river was long enough to purify itself' was accepted by many as representing the ultimate conclusion of science upon the subject. Recently data have been accumulating in the opposite direction and apparently indicate that under certain conditions streams do tend to become purer as they flow. A notable instance of this may be found in a report just issued by the Illinois State Board of Health on the Sanitary Investigations of the Illinois River and its Tributaries, with special reference to the effect of the sewage of Chicago on the Des Plaines and Illinois rivers prior to and after the opening of the Chicago drainage canal.

Advance notes upon the same subject, issued in 1900, gave the results of chemical and bacteriological examinations of samples of water at various points on these streams between Chicago and the Mississippi made during the summer and autumn of 1899, before the opening of the drainage canal. The present report gives, in addition to the figures then obtained, the results of further examinations made in 1900 with the drainage canal in use. The work was conducted by the State Board of Health, under the direction of Dr. John H. Long, professor of chemistry, Northwestern University Medical School, and Mr. Jacob A. Harman, civil engineer, of Peoria. Dr. Long was assisted in the qualitative bacteriological work by Professors F. Robert Zeit and Gustav Fütterer, of the Northwestern University Medical School. The reports of these gentlemen are prefaced by an introductory chapter of thirty-four pages by Dr. James A. Egan, secretary of the Illinois State Board of Health, upon the 'Pollution of the Illinois River as affected by the Drainage of Chicago and other Cities.' This contains a historical sketch of early investigations of the river, a compilation of various opinions upon the self-purification of streams and a summary of the results obtained by the recent investigations.

Dr. Long's report of the chemical and bacteriological examinations occupies seventy-seven pages and that of Mr. Harman, entitled 'A Preliminary Sanitary Survey of the Illinois River Drainage Basin,' one hundred and five pages. They include tables showing population, rainfall, stream gaugings, water-supply and sewerage statistics, analyses, etc. The brief report by Professors Zeit and Fütterer describes the various species of bacteria found at each station, with special reference to their pathogenic qualities.

The most interesting feature of the report is naturally the comparison of the condition of the Illinois River before and after the opening of the Chicago drainage canal. In order to appreciate this a knowledge of the local conditions is necessary. For many years the bulk of the sewage of Chicago has discharged into the Chicago River, a small stream with north and south branches uniting in the heart of the city to flow into Lake Michigan. This has been a menace to the public water supply, which is taken from the lake, and in order to lessen the danger a pumping station was established at Bridgeport in 1865, by which the water from the polluted south branch was pumped into the Illinois and Michigan canal, whence it found its way westward into the Illinois and Mississippi Rivers. This not being sufficient to relieve the situation in Chicago a drainage canal was designed to connect the Chicago River with the Des Plaines River, which is one of the streams which unite to form the Illinois River. A western outlet to Lake Michigan was thus provided, which naturally changed the current in the Chicago River. After ten years of construction the canal was opened on January 17, 1900. Prior to this from 30,000 to 50,000 cubic feet per minute was pumped at Bridgeport, and it has been estimated that in 1899 this contained from 85 to 90 per cent. of the total sewage of Chicago. Since the opening of the canal the actual amount of sewage sent westward has increased, but the amount of water has increased in a far greater ratio, the law requiring a minimum flow in the canal of 300,000 cubic feet per minute. According to Dr. Long's report the increased dilution thus brought about has resulted in an improved condition of the sanitary quality of the water in the Illinois

River. The analyses upon which this opinion is based are too extensive to reproduce here, but those who dwell in the lower Illinois valley and those who have feared the possible effect of the sewage of Chicago upon the water supply of St. Louis should observe the following emphatic statement of Dr. Long: He says: "I believe that it may be safely said that if the whole of the sewage of Chicago were to be excluded from the Illinois River, the condition at Grafton (where it enters the Mississippi) would remain unchanged so far as its organic contents and bacterial organisms are concerned."

The character of the Chicago sewage, the condition of the various tributary streams, the self-purification of the Illinois River and its subsequent pollution by Peoria and other cities are all fully discussed in the report.

The analytical work appears to have been carefully done, but it is to be regretted that certain portions of what is now considered to be a complete water analysis are omitted. For example, the amount of coloring matter was not measured and consequently the determination of oxygen consumed cannot be fully interpreted. The measurement of turbidity was likewise omitted; nor is any mention made of microscopical examinations. Determinations of dissolved oxygen and free carbonic acid, taken in connection with the other observations, would have thrown much light upon the self-purification of the stream. Nevertheless, the results as they stand are of great value and reflect credit upon those who conducted the work.

It is the intention of the Illinois State Board of Health to extend observations of this character to other streams until the sanitary survey of the state shall be complete.

G. C. WHIPPLE.

Leitfaden der Wetterkunde. Gemeinverstandlich bearbeitet von DR. R. BORESTEIN. Mit 52 in den Text eingedruckten Abbildungen und 17 Tafeln. Braunschweig, Friedrich Vieweg und Sohn, publishers. 1901. Price, 6 Mk.

This book is intended as a popular treatise on the weather, for the use of farmers, sailors and others whose pursuits are affected by the weather, and also for the benefit of all who may be interested in natural phenomena. Its object is to give the elementary facts of meteorology and explain the scientific principles on which weather forecasts are made. The author hopes thus to enable his readers to better understand and apply the forecasts as made by the national bureaus and to make forecasts for themselves. The publishers explain that among other new things embodied in the book are the results of the scientific balloon ascents and an account of the various weather services of the world.

The book is interestingly written and well illustrated. The distribution of rainfall and temperature over Europe is graphically illustrated by four colored charts. Perhaps the most attractive feature in the book is the reproduction of the best of the pictures from the International Cloud Atlas, showing in approximately natural colors the different types of clouds, all of which are derived from photographs. This is a feature that other text-books would do well to copy.

The chief criticism of the book is that it is written almost entirely from a German standpoint. The quotations are chiefly from German authors and the illustrations are derived chiefly from German sources. The only map of the world contained in the book is one illustrating the distribution of pressure. Several pages are given to describing the weather service of Germany; only a paragraph is given to the weather service of the United States. The balloon ascents quoted were those made by the German Aeronautical Society, and no mention is made of modern kite work. Perhaps this was intended by the author, as he was writing chiefly for German readers, but a foreigner misses the broad cosmopolitanism such as is found, for example, in the work of Dr. Hann.

H. H. CLAYTON.

Who's Who in America. A Biographical Dictionary of Notable Living Men and Women of the United States. Edited by JOHN W. LEONARD. Chicago, A. N. Marquis and Company. 1901–1902. Pp. xvi + 1304.

The initial edition of this work, published two years ago, made a niche for itself in current literature and a place for itself on the most

convenient shelf of the student; and the second edition, now in distribution, seems still more useful. Primarily the book is a biographic dictionary of a perfection approaching the ideal, in which the lives of prominent Americans are written in sufficient fulness for practical purposes; it is also a directory to prominent Americans by full names and present addresses. Naturally the first question as to the value of such a book connects itself with the classification, *i. e.*, with the definition of prominence and with the editor's success in equitably cleaving the mass of 80,000,000 into portions of 12,000 and 79,988,000, respectively, along the precise lines of the definition. Of course the performance of this task would out-Hercules the classic hero; it can never be done with mathematical precision, and even if it were made right for one day it would be wrong for the next; yet the chief excellence of 'Who's Who in America' lies in the truly remarkable measure of success with which the editor has established and maintained his primary definition. It is this measure of success in classifying prominence which gives the work its greatest utility; for the user may be reasonably certain of finding within it desired facts relating to any celebrity, and this without undue labor of search through irrelevant biographic material.

The 1899 edition contained 8,602 names, of which 752 are omitted in the 1901 edition, 498 by reason of known death, and the remaining 254 for various reasons; the later edition includes 11,551 names. Classified by residence (as they are in the introductory pages), these celebrities are distributed throughout the 45 States, 6 Territories and 1 District of the United States, and 47 foreign countries; 11,137 reside in the United States, 370 live permanently abroad, and 44 do not report. Of those resident in the United States 2,849 are credited to New York, 1,010 to Massachusetts, 889 to District of Columbia, 880 to Pennsylvania and 704 to Illinois; then follow Ohio, 422; New Jersey, 314; California, 291; Connecticut, 266; Missouri, 222; Maryland, 205; and the remaining States and Territories yielding less than 200 each of the aggregate. It would not be easy to class the celebrities by vocation, and the editor has not attempted to do so; but scientists may feel gratification in the fact that their important class has received especial care and effort, and that scientific eminence seems to have adequate recognition—indeed, scarcely a page is without one or more names distinguished in some line of scientific activity. Withal the book is a model of condensation and—considering the extreme difficulty of attaining accuracy in details of biography, bibliography, nomenclature, residence, etc.—a marvel of accuracy.

The new edition, like the old, is enriched by a readable prefatory narration of editorial experience, and still more by suggestive statistical tables, of which that entitled 'Educational Statistics' is a real contribution to knowledge. Of the 11,551 persons biographed, 9,760 furnished educational data, and in 8,141 cases the data permit useful classification. Of these 8,141 persons, 5,775 are collegians and 4,810 out of these graduates; 808 were educated only in common schools, 282 were privately educated, while 31 were self-taught. These figures, with the carefully selected data on which they rest, afford America's strongest argument in favor of higher education; at the same time they reveal the country's unparalleled element of strength in the possibility of eminence to those helped only by the public schools, and even to those not helped at all, along educational ways.

The book is notably fit in size, weight, quality of paper, typography, abbreviations, binding, and other matters which go to make up satisfactory book-making.

W J M.

SCIENTIFIC JOURNALS AND ARTICLES.

The *Botanical Gazette* for July contains the following papers: Charles E. Allen writes 'On the Origin and Nature of the Middle Lamella.' The general conclusion is reached that this structure is not merely the partition wall as laid down, either as a single or a double layer; nor is it merely an intercellular substance or cement, a means for binding the cells together. It is a wall layer with a complicated history, undergoing after its appearance changes in form, in mass, and in chemical composition. Carleton E. Preston has written upon 'Structural Studies of Southwestern Cactaceæ.' From a study of eight representative forms various

conclusions are reached, among which are the following: There is a slight variation in the roots as regards branching and vascular limits; in the stem there is a great range of structural deviations, which take place along definite lines and by definite steps, the variation extending to bundle branching and reticulation, extent of succulence, character of parenchyma, of pith and cortex, development of mucilage, and even to the kinds of elements entering into the xylem. Suggestive results from the systematic point of view were also obtained. Alfred Rehder has written upon *Vasilima* and *Schizonotus* of Rafinesque, both of which he regards as properly synonyms of *Sorbaria*. Arthur Bennett makes the first record of the appearance of *Potamogeton polygonifolius* in Newfoundland, the only other known North American situation being on the island of Nova Scotia.

In the numbers for August and September three continued papers appear. Dr. F. L. Stevens has written upon 'Gametogenesis and Fertilization in *Albugo*'; and Dr. W. L. Bray upon 'The Ecological Relations of the Vegetation of Western Texas.' Both of these papers will be noticed upon their conclusion in the October number. The third paper is by Dr. Florence May Lyon, entitled 'A Study of the Sporangia and Gametophytes of *Selaginella apus* and *S. rupestris*.' The description of *S. apus* is the first account yet published of the details of development of both gametophytes of any species of *Selaginella*. A preliminary study of the megaspore and female gametophyte of *S. rupestris* is added. The most striking fact observed is the persistent retention of the megaspores within the unshed sporangia throughout the formation of the prothallium and of the embryo. In the case of *S. rupestris*, at the time the strobilus is separated from the plant by the decay of the vegetative part beneath, it appears covered with sprouting plantlets. The megaspores of *S. apus* are shed before the embryo has emerged. The significance of this sequence of events lies in the resemblance to the formation of seeds in the higher plants. But one or two megaspores of *S. rupestris* form, whereas the normal number four appears in *S. apus*. The description of the male gametophyte differs from that given by Belajeff. It consists of a single cell, presumably the vestige of the prothallium, and the two masses of spermatozoid-producing cells. Fertilization is accomplished in a manner suggestive at least of the seed plants. The microsporangia open with force when the male gametophytes are mature, and the latter are shed like pollen grains. The outer wall of the microspore has cracked open at this stage and the endospore protrudes in a papilla-like protuberance like a very short pollen tube. This ruptures and the spermatozoids are freed in a mass of slime that is attracted toward the archegonia. Microspores were found within the megasporangia, having been hurled in when the latter were gaping open. The bryophyte-like character of the spermatozoids claimed for the Lycopodiaceæ was not demonstrated in these two species. As regards their form they were typically fern-like, spirally coiled, and the presence of cilia not determined. The methods by which the strobili were sectioned with their nut-like spores *in situ* is given in detail.

In all the numbers there are the usual 'Briefer Articles,' 'Reviews of Current Literature' and 'News Items.'

THE August number of the *American Geologist* contains a history and biographical sketch of the late George M. Dawson, of Canada. The paper is accompanied by a portrait of Mr. Dawson and a bibliography of his writings. 'The Pleistocene Problem of the North Atlantic Plain,' by Geo. Shattuck, contains a discussion of the views of W J McGee and N. H. Darton followed by those of Professor R. D. Salisbury. The writer concludes by stating his own views based on considerable field work in the area. He claims that five terraces have formed in this period and he approaches their study through a study of the present work of the Chesapeake and the Atlantic Ocean. For these four formations below the present terrace he proposes the following names: (1) Talbot, (2) Wicomico, (3) Sunderland, (4) Lafayette. In the editorial comment is an extended description of 'The Department of Geology in the National Museum.' This discussion is accompanied with five plates illustrating types of the various

collections. Following this is the 'Review of Recent Geological Literature' and the 'Author's Catalogue of Recent Geological Literature.' The September number contains a valuable discussion of 'The Basic Rocks of Northeastern Maryland and their Relation to the Granite,' by Alfred Gray Leonard. The author describes several rocks, all from a limited area, ranging from acid to ultra-basic. He attempts 'to show that these types are intimately associated in their geological occurrence and closely related in composition; that many of the types graduate into others by intermediate varieties, and that they probably represent facies of one original magma.' The article is accompanied by four plates of microphotographs illustrating rock structures, and a map showing the distribution of the varieties in the area studied. 'A Preliminary Geologic Section in Alpena and Presque Isle Counties, Michigan,' by Amadeus W. Grabau, has a plate showing a geological section at Thunder Bay accompanied by a description of the various outcrops. This is followed by 'Editorial Comment on the Archæan of the Alps.'

The October number of the *American Journal of Mathemathics* (Vol. XXIII., No. 4) has the following articles:

Memoir on the Algebra of Symbolic Logic, by A. N. Whitehead; Secular Perturbations of the Planets, by G. W. Hill; Representation of Linear Groups as Transitive Substitution Groups, by L. E. Dickson; A Class of Number Systems in Five Units, by G. P. Starkweather.

The Osprey for August contains articles on 'Birds about Lake Tahoe,' by Milton S. Ray; 'Life History of the Prairie Warbler,' by Jno. W. Daniels, Jr.; 'Camping on the Old Camp Grounds,' II., by Paul Bartsch; 'Cage Birds of Calcutta,' by Frank Finn, and the seventh instalment of 'The Osprey or Fishhawk: Its Characteristics and Habits,' by Theodore Jill.

DISCUSSION AND CORRESPONDENCE.

DIFFERENTIATION OF SUBJECTS AND TITLES IN COLLEGES.

In your last issue Professor F. W. Rane makes objection to the all-comprising title of professor of agriculture, and very properly points out that the subject is now so differentiated that the nomenclature in professorship should follow suit. While the claim is perfectly proper, I cannot suppress a smile in reading the signature of the 'Professor of Horticulture and Forestry.' Why should not Mr. Rane begin differentiation at home? Horticulture and forestry are two so widely different subjects that the man who proposes to teach them both must, indeed, be able to turn his coat most readily. Both, to be sure, have to deal with trees, being both branches of the wider field of arboriculture; but each deals with entirely different classes of trees, for entirely different purposes by, entirely different—I might almost say opposite—methods. The forester is after the substance of the tree; the final object of his efforts is attained by the cutting, the removal of the tree. The horticulturist's object is not the substance but the fruit, or, if he be a landscape gardener, the form and beauty of the tree, both aims being only fulfilled by the presence of the tree. These different objects are attained by entirely different methods, as could be readily pointed out, did space permit.

I would not wish to discourage any laudable attempt to make students of horticulture and of other agricultural branches know something of forestry, but it is a question whether they can get much professional knowledge of either the one or the other subject from an undifferentiated professor of horticulture and forestry. As we have now two fully organized colleges of forestry, the one at Yale with two, the other at Cornell with three, professors of forestry, without any other branches to teach, it would appear quite time for other colleges, who find it necessary or desirable to educate foresters, to realize the wide difference between the various branches of arboriculture, and not mix up botany, horticulture, landscape gardening and forestry in their courses and professors' titles.

B. E. Fernow.

New York State College of Forestry.

A FINAL WORD ON DISCORD.

To The Editor of Science: Mr. Max Meyer, in his criticism a few weeks ago, implied that I had made a mistake in a book review. This,

it appears, was not because I had objected to a certain numerical statement about discord, but because I had referred to a curve by the late Professor Mayer which Mr. Meyer considers worthless. The work of Helmholtz in the same domain he also considers worthless. He quotes Melde and Stumpf, who differ with Mayer and Helmholtz. He concludes by saying "Upon the *cause* of discord the psychologists have *not* agreed; it is yet unknown—at least to the psychologists."

For many years I have been convinced that beats do not constitute the sole cause of discord, but that probably they constitute one efficient and important element. So far as this may be admitted, Mayer's curve is the nearest approach to an expression of facts within the range he selected. The present controversy seems to be chiefly regarding authorities. Criticism intended to be destructive is not a substitute for constructive evidence. The opinions of Melde and Stumpf are of course worthy of respect, but they do not prove Helmholtz and Mayer to be wholly wrong. It does not seem to me that the subject is of sufficient importance to call for further discussion.

W. LE CONTE STEVENS.

WASHINGTON AND LEE UNIVERSITY,
October 12, 1901.

THE BICENTENNIAL OF YALE UNIVERSITY.

THE program of the bicentennial exercises of Yale University being celebrated this week is as follows:

MONDAY, OCTOBER 20.

10:30 A. M.—Divine service in the Battell Chapel. Sermon by the Rev. Joseph Hopkins Twichell, A.M.

Special divine services in Center Church, sermon by the Rev. Newman Smyth, D.D.; in the United Church sermon by the Rev. Joseph Anderson, D.D.; in Trinity Church, sermon by the Rev. Walton Wesley Battershall, D.D.; and in the First Methodist Church.

3:00 P. M.—Address by the Rev. Professor George Park Fisher, D.D., LL.D., on 'Yale in its Relation to Christian Theology and Missions'; Battell Chapel.

8:00 P. M.—Organ recital by Professors Samuel Simons Sanford, A.M., and Harry Benjamin Jepson.

SUNDAY, OCTOBER 21.

9:30 A. M.—Dedication of the Ives-Cheney Memorial Gateway.

10:30 A. M.—Address by Thomas Thacher on 'Yale in its Relation to Law'; Battell Chapel.

Address by Professor William Henry Welch, LL.D., on 'Yale in its Relation to Medicine'; Battell Chapel.

3:00 P. M.—Address of welcome to guests by President Arthur Twining Hadley, LL.D., with responses; Battell Chapel.

5:00 P. M.—Reception of the guests of the university and representatives of the alumni by President Hadley, in the Yale Art School.

8:00 P. M.—Assembly of students and graduates on the campus.

9:00 P. M.—Torchlight procession of students and graduates.

TUESDAY, OCTOBER 22.

10:30 A. M.—Address by President Cyrus Northrop, LL.D., on 'Yale in its Relation to the Development of the Country'; Battell Chapel.

Address by President Daniel Coit Gilman, LL.D., on 'Yale in its Relation to Science and Letters'; Battell Chapel.

2 P. M.—Football games at Yale Field; Yale University vs. Bates College; Yale University vs. team of graduates.

4:30 P. M.—Choral performance of Professor Horatio Parker's 'Hora Novissima,' by the Gounod Society and the New Haven Symphony Orchestra; Hyperion Theater.

8 P. M.—Illumination of the campus; student dramatic performance and singing in the campus amphitheater.

WEDNESDAY, OCTOBER 23.
(Commemoration Day.)

10 A. M.—Assembly of guests and graduates on the campus.

10:30 A. M.—Procession of guests and graduates to the Hyperion, as escort to President Roosevelt.

Commemorative poem by Edmund Clarence Stedman, L.H.D., LL.D.

Commemorative address by David Josiah Brewer, LL.D.

Orchestral and choral music.

Greek festival hymn by Professor Thomas Dwight Goodell, Ph.D., the music by Professor Horatio Parker, A.M.

Conferring of honorary degrees on President Roosevelt and others.

2:30 P. M.—Concert by the Boston Symphony Orchestra, Mr. Wilhelm Gericke, conductor; Hyperion Theater.

4 P. M.—Dedication of Woodbridge Hall.
Address by Donald Grant Mitchell, LL.D.
5 P. M.—Farewell reception of the guests and graduates of the University by President Hadley and Mrs. Hadley, in the University Hall.

RESOLUTIONS ON THE RESIGNATION OF THE PRESIDENT OF COLUMBIA UNIVERSITY.

THE Council of Columbia University, representing the faculties, has adopted the following minute, on the occasion of the resignation of President Low:

When Mr. Low became the President of Columbia College, in the academic year 1889 90, the institution consisted of four faculties, in charge respectively of the schools of arts, mines, law and political science. These faculties numbered 122 officers of instruction; and these schools were attended by 1,134 students. The faculties were connected with each other only through the president and trustees of the college; and the schools existed alongside of each other without any principle or custom of reciprocity. The library of the college contained 91,000 volumes, and the wealth of the corporation was estimated at $10,500,000. The faculties, schools, library and entire equipment were crowded into the narrow and noisy quarters bordering upon the tracks of the New York Central railway.

To-day Columbia University consists of nine faculties, in charge respectively of Columbia College, Barnard College, Teachers College and the university schools of law, medicine, applied science, pure science, philosophy and political science. These faculties now number 385 officers of instruction; and these colleges and schools are now attended by 4,500 students. The faculties are now coordinated with each other in the University Council in which all of the educational activities and interests of the university are officially represented; and a complete system of reciprocity between all parts of the institution and also with the Union Theological Seminary now prevails. The library of the university now contains 311,000 volumes; and the wealth of the corporation is now estimated at eighteen millions of dollars, of which one and one half millions of dollars, in round numbers, represent the splendid generosity and munificence of Mr. Low himself. And, finally, the university is now located upon a site and possesses a physical equipment unsurpassed in beauty, comfort and completeness by those of any institution of learning in the world.

This magnificent achievement, wrought within the short period of twelve years, has no parallel in the educational history of any country or of any age; and no further or higher proofs of Mr. Low's abilities as an educator and an administrator than the mere recital of these facts are necessary.

But Mr. Low brought to the solution of the problems of the university qualities even more important and needful than these intellectual powers. First and highest among these qualities, and most indispensable, was the power to win and to hold the full and unwavering confidence and the cordial and zealous cooperation of all his colleagues, a power which can come only from an innate love of truth, joined with an open mind, a high sense of justice, unbending integrity, kindness of heart and genuine deference in manner. Every officer of the university felt that his interests and the interests of his department were safe in the hands of Mr. Low, and that no occult influences would ever be allowed to prevail in the administration of the affairs of the institution.

"It is the recollection of these rare and invaluable traits even more than of his administrative abilities which makes the parting with him so hard and regretful and which moves this Council to express the hope and wish for itself and for the bodies represented in it that from his seat in the Board of Trustees of the University Mr. Low may still continue to manifest his old interest in the development of the university and may still exert his great powers in the promotion of its welfare.

"Though conscious that these words do not express with any adequacy the feelings of the members of this body concerning the obligations of the university and all of its officers to Mr. Low and their deep regret at his retirement from the Presidency yet your committee would beg to recommend that the minute be spread in full upon the records of the University Council and that the Secretary be directed to transmit a copy of it with a suitable letter to Mr. Low."

THE CARNEGIE TECHNICAL SCHOOLS.

THE report of the committee of the Board of Trustees of the Carnegie institutions at Pittsburgh has been made public. It formally approves the scheme of the sub-committee and of the advisory committee of experts on the 'Plan and Scope' of the proposed Carnegie technical system of industrial education, as outlined by the latter in the report published in SCIENCE in July last and commented upon in the address of Mr. Brashear before his section of the American Association for the Advancement of Science, which appeared in our issue of September 13.

The committee recommends the organization

of the central feature of a scheme to comprehend, ultimately, if properly sustained, a series of schools of graded character from the evening classes and the trade schools for artisans and youth, of both sexes, to the technical high school, the schools of engineering and architecture aggregated in a technical college, and to the aggregations of these schools and colleges in a technical university which shall include a department of research. It is proposed to employ the gift of Mr. Carnegie, presented at the time of his announcement of his ambition in this direction, in the establishment of a technical institution to occupy substantially the same position and to do practically the same kind of work as the Pratt Institute in Brooklyn, the Drexel in Philadelphia and similar schools in other large cities. It is recommended that a plot of land of about 60 acres area be at once secured and this institution immediately organized.

"The plan and scope as laid down by the commitee and the experts invited to give counsel will make the school of national importance and place it in the front rank of similar schools in the world."

The endowment at present advised is said to be $5,000,000, and the final and completed form of the 'university' will presumably require about double that sum.

When studying a plan and determining the scope of the institution, the expert advisers were called upon, each for a statement, and were later called together as a committee, and the present report states that 'appreciating the dignity and the magnitude of the subject, we were agreeably surprised to find that all reports agreed in their essential features.'

"Accordingly when the members of the Advisory Committee held their final meeting in June they had no difficulty in uniting in a general scheme for technical education."

The scheme was in outline the largest possible; the idea being to provide a model, so far as it might be carried, and to hold up an ideal toward which to approximate as time and means should permit. The introduction of manual training, in cooperation with the public schools, and a general system and policy of constant cooperation in all practicable ways, the provision of day and evening classes for artisans, the organization of a scientific and technical high school for youth of both sexes unable to find means and time for a liberal education and yet requiring instruction in the fundamental principles of the industries into which they are to be inducted, together with provision for general education, in conjunction with the public schools, the neighboring university, the great libraries of Pittsburgh and vicinity and with the operations of the existing Carnegie Institute, art school and museum, constitute the first and a great task. Later, if practicable, the educational structure will be built up and down and broadened into a great system offering the industrial classes Huxley's ladder 'from the gutter to the university.'

"The Carnegie Technical College with its crowning features of scientific research and publication, must be left for future endowment. Its realization would complete a technical university unequaled in its scope and influence, an institution worthy to foster the highest aspirations of Pittsburgh—or of any metropolis, the committee might have added."

Finally, the committee remarks: "We would respectfully suggest to Mr. Carnegie the many advantages to be derived from handling as a whole, rather than in parts, whatever scheme of technical education he may contemplate."

"The Advisory Committee wisely recommends that an endowment should be provided of such magnitude and character as will safely maintain the required income on the face of falling rates of interest and the demands of a steady growth."

THE NEW YORK PATHOLOGICAL INSTITUTE.

ANNOUNCEMENT is made that the plan of reorganization of the Pathological Institute of the New York State Hospitals for the Insane undertaken by the State Commission in Lunacy is gradually taking shape. An advisory board has been appointed, whose duty it is to aid in the development of the Institute and the carrying on of its work on broad lines and to assist the new Director soon to be appointed. It is the aim of the reorganized Institute to carry on work in the sciences correlated with psychiatry

according to the original plan, but with some modifications intended to meet more immediately the needs of the hospitals. Original research in the various sciences having a bearing upon the subject of insanity will go on as before, but in addition the Institute will be utilized to give special instruction in clinical psychiatry, as well as methods of scientific research to the physicians on the staffs of the hospitals for the insane and to young men about to take up an asylum career. In order to obtain this clinical experience the Institution needs to be combined with a hospital for the insane, and to bring this about it is for the present to be connected with one of the asylums on Ward's Island, and until such time as a reception hospital for the insane can be established in Manhattan. In selecting the members of the Advisory Board, the Lunacy Commission deemed it expedient to have the three University Medical Schools of New York City represented, *viz.*: Columbia, Cornell and Bellevue-University. Furthermore it was decided to accord to the chief sciences correlated with psychiatry representations upon the Advisory Board. These sciences are pathology, chemistry, psychology and general biology. Inasmuch as the Pathological Institute was created for the utilization of the material of all the State hospitals, and for the purpose of raising the standard of scientific study, treatment and care of the insane under State care, it was thought best that these institutions should also have a voice upon the Advisory Board. A member to represent general clinical medicine and neurology was likewise selected. Accordingly the Commission in Lunacy has established an advisory board consisting of the following men: James Ewing, Professor of Pathology, Medical Department of Cornell University; Dr. Christian A. Herter, Professor of Pathological Chemistry, Bellevue and University Medical College; Dr. J. McKeen Cattell, Professor of Psychology, Columbia University; Dr. Hermon C. Bumpus, Assistant to the President of the American Museum of Natural History, to represent the department of General Biology; Dr. Henry Hun, Professor of the Diseases of the Nervous System, Albany Medical College, to represent Neurology and General Clinical Medicine; Dr. Charles W. Pilgrim, superintendent of the Hudson River State Hospital, at Poughkeepsie, and Dr. A. E. Macdonald, superintendent of the Manhattan State Hospital, East, to represent the State Hospitals; Dr. Frederick Peterson, President of the Lunacy Commission, a member ex officio. All appointments to the advisory board are permanent except two. The two superintendents of asylums on the board were elected by the fourteen asylum superintendents of the State at a meeting held in Buffalo, September 28, for a term of two years only, thus permitting all the asylums to be represented in rotation on the board.

THE AMERICAN PHILOSOPHICAL SOCIETY.

A COMMITTEE of the American Philosophical Society has sent to members the following letter in regard to an annual general meeting of the Society in Easter week:

The American Philosophical Society, animated by the desire which led its founder, the illustrious Franklin, to issue his 'Proposals for promoting Useful Knowledge among the British Plantations in North America,' and which in 1743 resulted in the formation of this Society on a national basis, and in the selection of Philadelphia as its seat, because of its 'being the city nearest the centre of the continent colonies,' has for some time recognized the fact that the changes which the lapse of 158 years have wrought, demand modified conditions to meet existing requirements.

Ever since its foundation the national character of the Society has been maintained. In consequence there has latterly arisen among its members a conviction that the time has come when the interests of useful knowledge in the United States can be greatly promoted by the holding, in addition to its usual semi-monthly meetings, of at least one general meeting in each year, which from the information to be derived from the papers presented and their discussion by those most competent to add to our knowledge, shall attract the members of the Society from all parts of the country to their mutual advantage as well as to that of this, the first and oldest scientific society in America, and one of the oldest in the world.

With this view the Society has authorized the holding of a general meeting which for the ensuing year has been fixed in Easter week and the undersigned have been appointed a committee to make the necessary arrangements.

Members desiring to present papers, either for themselves or others, are requested to send to the secre-

taries at as early a date as practicable and not later than February 15, 1902, the titles of the papers, accompanied by a brief abstract, so that they may be duly announced on the programme which will be issued immediately thereafter and which will give in detail the arrangements for the meeting.

The Publication Committee, under the rules of the Society, will arrange for the immediate publication of the papers presented.

It should be borne in mind that the Society, by means of its publications, which present a series covering 140 years and include *Transactions* in quarto and *Proceedings* in octavo, with its large exchange list embracing, practically, the scientific societies of the world, and with its exceptional facilities for immediate issue, offers unrivalled avenues for prompt publication and wide circulation of the papers read before it.

Mindful of the brilliant history of the Society, extending back into the first half of the eighteenth century, its members should obviously be solicitous that its career at the outset of the twentieth century shall fully maintain the high prestige which the preceding centuries have given to it both at home and abroad. Hence it is felt that with their cordial and active cooperation secured the proposed general meetings may be made a powerful factor in advancing the interests for the promotion of which the Society was founded.

SCIENTIFIC NOTES AND NEWS.

A MEETING of the executive committee of the American Society of Naturalists was held at Boston on October 19, to complete the arrangements for the Chicago meeting of the Naturalists and affiliated societies. The meeting of the Naturalists will be on Tuesday and Wednesday of Convocation week, that is December 31 and January 1. The discussion before the Naturalists will be on Wednesday afternoon, and the annual dinner, at which the president, Professor Wm. T. Sedgwick, will give the address, will take place in the evening. The subject selected for the discussion is 'The Relations of the American Society of Naturalists to other Scientific Societies.'

DR. WILHELM WALDEYER, professor of anatomy in the University of Berlin, has been sent by the University of Berlin and the Berlin Academy of Sciences as their representative at the bicentennial exercises of Yale University.

A GOLD plaque will be presented to M. Berthelot next month to celebrate the fiftieth anniversary of his entering as an assistant the chemical laboratory of the Collège de France.

MR. BARBOUR LATHROP, of Chicago, and Mr. D. G. Fairchild, of the U. S. Department of Agriculture, will leave San Francisco next month on another expedition, with a view to investigating exotic plants that might be introduced into the United States. They go first to the South Sea Islands and Australia and later to India.

PROFESSOR W. B. SCOTT, of Princeton University, is still in South America, working on the Patagonian Expedition Reports. When last heard from he was at Buenos Ayres, examining specimens in the museums of that place.

THE Hanbury gold medal for 1901 was presented on October 1 to Dr. George Watt by the president of the Pharmaceutical Society. This medal, which was established as a memorial to Daniel Hanbury, is awarded biennially for original research in the chemistry and natural history of drugs.

THE council of the Institution of Civil Engineers has, in addition to the medal and prizes given for communications discussed at the meetings of the institution in the last session, made the following awards in respect of other papers dealt with in 1900–1901: A Telford medal and a Telford premium to Reginald Pelham Bolton (New York); a Watt medal and a Telford premium to J. Emerson Dowson (London); a George Stephenson medal and a Telford premium to W. T. C. Beckett (Calcutta); a Manby premium to E. K. Scott (London); a Trevithick premium to T. A. Hearson, R.N. (London); a Telford premium to J. A. W. Peacock (Tantah, Lower Egypt).

DR. NORMAN MOORE gave the Harveian Oration before the Royal College of Physicians, London, on October 18.

PROFESSOR ROBERT KOCH has been sent by the German Government to Gelsenkirchen, where there is a serious outbreak of typhus, as many as fifty cases being reported in a single day.

DR. CHARLES HENRY BROWN, a New York physician, who has given special attention to nervous diseases and had for many years been

editor of the *Journal of Nervous and Mental Diseases*, died on October 15, at the age of fifty-four years.

GEORGE B. SIMPSON, for thirty-five years the accomplished delineator of fossils for the paleontological department at Albany and a well-known student of the fossil Bryozoa, died on October 15.

M. R. KÖNIG, of Paris, well known for his scientific instruments and his investigations on acoustics, has died at the age of sixty-nine years.

MR. WILLIAM WEST, known for his study of fresh-water algæ, has died in India from cholera, at the age of twenty-six years.

THE deaths are also announced of Dr. Peter M. Pokrowskij, professor of mathematics at the University of Kiew, and of Dr. Alex. F. Berger, docent in mathematics in the University of Upsala.

THE next International Congress of Physiologists will be held at Brussels in 1904, under the presidency of Professor Heger.

THE Nineteenth Congress of the American Ornithologists' Union will convene at the American Museum of Natural History, New York City, on Monday, November 11, at 8 o'clock p. m. The evening session will be devoted to the election of officers and members and the transaction of other routine business. The meetings, open to the public and devoted to the reading and discussion of scientific papers, begin on Tuesday morning and continue for three days. In connection with the Congress there will be a conference of representatives of the Audubon Societies, for the purpose of forming plans for more effective cooperation.

THE Coast and Geodetic Survey steamers *Pathfinder* and *MacArthur* have nearly completed the survey of the Fox Island channels which form the entrance or exit for all Bering Sea commerce. The steamers *Patterson* and *Gedney* are now charting Cross Island and Icy Straits, of the Southeast archipelago. The *Pathfinder* will proceed to the Philippines before long via Nagasaki to take up the work of surveying called for by the Philippine Commission.

THE Antarctic expedition from Sweden, under the direction of Professor Otto Nordenskjöld, left Götenberg on the steamship *Antarctic* on October 16. Professor Nordenskjöld is accompanied by Professor Ohlin, the well-known explorer, and M. K. A. Anderson, as zoologists; Dr. Bodman, hydrographer and magnetician; M. Skottoberg, botanist, and Dr. E. Ekolof, medical officer. Captain Larsin, a Norwegian, who has already made several voyages to the South Polar regions, is in charge of the *Antarctic*. The vessel will proceed to Terra del Fuego and thence to the South Polar regions, where the field of exploration will not conflict with those chosen by Great Britain and Germany. Professor Nordenskjöld expects to land with a party while the vessel makes explorations about Terra del Fuego.

As we have already announced the coast and Geodetic Survey has established a magnetic observatory at Sitka, Alaska, and is constructing another at Honolulu. These observatories will cooperate with the German and British Antarctic expeditions in making simultaneous observations.

As the daily papers have very fully reported M. Santos-Dumont in his air ship on October 19, succeeded in circumnavigating the Eifel Tower and returning to Saint Cloud. The trip was made within the half hour allowed by M. Deutsch for the award of his prize, but owing to a delay in landing the prize was not awarded.

REUTER'S AGENCY gives the following information concerning Dr. Sven Hedin, the Swedish traveler, based upon a letter from him, dated July 10. It appears that Dr. Sven Hedin, at the time of the dispatch of the letter, was at the foot of the Akka Tagh, in Northern Thibet, and intended to proceed in the direction of Ladak in order to survey accurately the region about the source of the Indus. Next spring he proposed to return to Osh via Kashgar. Meanwhile, a caravan of 15 horses has arrived at Kashgar bringing the results of two years of the traveler's work in the shape of scientific collections, maps, photographs and diaries.

R. W. AMIDON, M.D., of New York City, is spending October and November near Chau-

mont, Jefferson County, N. Y., investigating ancient village sites. In this region there are mounds of various sizes, in the top of each of which is a saucer-shaped depression that is in every case about eight feet in diameter. It seems possible that these mounds may be the remains of earth-covered houses of various sizes, which had smoke holes approximately of the same diameter.

DR. MARCUS S. FARR, assistant in geology at Princeton, and Mr. Earl Douglass, fellow in biology, with a party of students spent the summer in geological explorations in the southern part of Montana. Valuable fossils were collected and are now being mounted at Princeton.

IT appears that there will be no further contest in regard to the will of the late Jacob S. Rogers and that the Metropolitan Museum of Art will receive over $5,000,000 for its endowment. It is perhaps scarcely necessary to state that the Museum includes archeology, as well as the fine arts, in its scope, and this large bequest will thus directly contribute to scientific work.

THE principal buildings for the St. Louis Exposition, as officially decided upon, will in many cases be larger than buildings constructed for similar purposes at previous expositions. There is to be an agricultural building, 700 by 2,000 feet; a manufacturers' building, 600 by 600 feet; a liberal arts building, 600 by 1,200 feet; a social economy building, 550 by 700 feet; a transportation building, 600 by 1,200 feet; an education building, 550 by 700 feet; an art building, 300 by 600 feet, with two wings, each 200 by 300 feet; a mines and metallurgy building, 600 by 1,200 feet; an electricity building, 600 by 550 feet, and a Government building, to cover 100,000 square feet. The estimated cost of these buildings is $7,000,000. To these will probably be added buildings for fish and fisheries, for machinery, for forestry and for horticulture.

WE learn from *Nature* that a small residential laboratory has been opened at the Hakgala Botanic Gardens, near Nuwara Eliya, at an elevation of 5,600 feet above sea-level. The laboratory is a branch of the Peradeniya Institution, and consists of a small building containing a working room 21 feet x 12½ feet, a living room, two bedrooms, kitchen, etc. The climate is temperate, fires being required in the evenings at least. The botanic garden itself is said to be very beautiful, and occupies an unrivaled position for the study of equatorial hill vegetation, for on one side there are jungles stretching for 25 miles or more into the wet region of the hills, on the other grassy plateau reaching for an equal distance into the dry region, and extending from 3,000 to 7,000 feet above sea-level. The garden itself contains both jungle and patana reserves of several hundred acres.

A COMMITTEE appointed by the recent German Geographical Congress has offered a prize of at least $150 for a paper on 'The changes in the course of the Rhine between Bonn and Cleves in historic times, and how have they affected the settlements on its banks?'

THE foreign journals report that the Berlin Academy of Sciences and the Danish Academy at Copenhagen have decided to prepare a collection of all the medical works of antiquity under the title of 'Corpus Veterum Medicorum,' and will cause a thorough examination to be made of all libraries, Oriental and European, which are likely to contain MSS. dealing with medical subjects.

THE letter press of Britton and Brown's 'Illustrated Flora,' with some abridgment and numerous emendations, but without the illustrations, has been compressed into a single portable volume, which is to be published at once by Henry Holt & Co., under the title, Britton's 'Manual of the Flora of the Northern States and Canada.'

A REPRESENTATIVE of Reuter's Agency reports an interview with Herr Oscar Neumann, the eminent German explorer, who has recently completed an eighteen months' journey in Central Africa from Zeila to Khartum. Traveling for the most part through absolutely unknown country, he made some valuable discoveries, and has brought home the largest zoological collection ever made in Central Africa. He was also enabled to make a complete geological

survey. He met with no hostility on the part of the natives and had no fighting during the whole journey. The physical difficulties were, however, often very great. Describing his journey, Herr Neumann said: "Baron Erlanger and myself, accompanied by three Europeans—Dr. Ellenbech and Messrs. Heutemuller and Hillgart—left Zeila in January of last year, and journeyed into Somaliland, where we had considerable difficulty, and were unable to proceed east owing to the movements of the Mad Mullah. After crossing the Shibel River we traversed with difficulty a district full of caves and came to the land of the Arosi Galles. We visited the holy towns of Sheikh Hussein and the holy mountains of Abulnass and Abulcassim, which have never previously been explored. Subsequently we traveled northwest by a new route to Adis Abeba, crossing a plateau 9,000 feet high. We left the capital in November last, and proceeded southwest along the lakes to Lakes Stephanie and Rudolf. We adopted the new eastern route of the Great Rift Valley instead of following the tracks of Captain Wellby or Mr. Harrison. Between the Hawash River and Lake Stephanie we discovered that, instead of five lakes, there are no less than seven lakes, probably all relics of the great diluvial lake basin. After a slow and tedious journey we crossed the Omo River and traveled through the quite unknown Abyssinian provinces of Ksha and Konta, which have only been occupied since the Italian war. Subsequently I came to Kaffa, one of the richest provinces of Abyssinia, covered with dense forest, in which there is much coffee cultivation. My object now was to explore the sources of the Gelo River, an important affluent of the Sobat. I first passed through the land of Gimirra and the independent countries of Binescho and Scheko. Shortly afterwards I found the Gelo River and followed its course, but the further I proceeded the more difficult became the traveling. My caravan was now in a terrible plight. Glanders had again broken out, and out of 65 animals I had only 13 mules, two horses, and two donkeys left. I was therefore compelled to throw away tents, clothes, stores, etc., in fact everything but my books and collections. Our condition was made harder by reason of the fact that we were going through a country which had almost been depopulated owing to Abyssinian raids. Suddenly a steamer appeared, having on board Slatin Pasha and Bluett Bey, Mudir of Fashoda, who took us in safety to Khartum." During the whole of this long and arduous journey Herr Neumann never had any trouble with the natives.

Before the Section of Mathematics and Physical Science of the British Association, Dr. R. T. Glazebrook, the superintendent of the National Physical Laboratory, exhibited plans of the new institution now being erected at Bushey, gave a short history of the building, and described the objects with which it has been founded. According to the account in the London *Times* he said that the main building consisted of a substantial central block about 70 feet square standing on a vaulted basement. At each corner there was a large wing practically single-storied; the rooms in these were being fitted up for various special purposes. In the central building itself would be two general laboratories. There would be a large entrance-hall, arranged as an apparatus room, and a library. The basement contained six rooms of fair size; the floor had been covered with a thick layer of concrete. The walls were very thick, so that they were extremely steady, and the temperature and conditions all favorable for steady work. In addition there were other smaller rooms in the basement; two of these were entirely surrounded by thick interior walls and arrangements would be fitted to maintain a steady temperature throughout the year. At the back was another wing containing a number of rooms suited for special researches, and there a lift had been fitted and also a mercury column having a height of about 50 feet. For the more delicate physical work the ground-floor and basement of the old house afforded ample accommodation. For the engineering work a room 80 feet by 50 feet had been built, lighted from the north by a weaving shed roof. It was divided longitudinally into two bays by a series of rolled steel pillars. The one bay would contain a light traveling crane; along the other ran a line of shafting for driving the machinery and for experimental purposes. Adjoining this

laboratory was a drawing office, while the engine-house and boiler rooms were close at hand. Power, obtained from a 60-kilowatt Parsons turbine, would be distributed electrically to various parts of the laboratories; this form of engine was chosen for the express purpose of avoiding vibration as far as possible. The necessary tools were in order and in course of installation. The work which the committee hoped to attack in the first instance was that which had already been under the consideration of the Alloys Research Committee of the Mechanical Engineers. Apparatus for the photomicrographic examination of steel rails was being set up, and machines for testing the elastic properties of alloys were in course of construction. Pressure gauges and steam indicators would also be tested. The height of the building would not allow the mercury column, now being erected, to measure more than 200 pounds to the square inch, but apparatus was being constructed for pressures in excess of that amount. Considerable attention was to be given to high temperature thermometry, the testing of platinum thermometers, and the measurement of electrical quantities. Before the end of the year the committee hoped the laboratory would be fully and usefully occupied. Acknowledgment was made of the generosity of Sir Andrew Noble, who had given an excellent comparator, a dividing engine, and some measuring apparatus of the highest class to the laboratory.

AT the recent Glasgow meeting of the British Association, Dr. A. G. Green read before the chemical section a paper on the coal-tar industry. According to the report in the London *Times*, he remarked that, owing to the numerous ramifications of the coal-tar industry and the manifold applications to which its products were applied, it might be regarded as the pulse of chemical industry as a whole. He had, therefore, traced the relative progress in the industry in England and Germany during the last fifteen years. At the commencement of that period England, although the originator of the manufacture of analine dyes, was not holding its own against Germany, but was, at any rate, supplying Germany with the raw material. Now, even that was not the case, for owing to the ample introduction of coke ovens, in which the by-products were recovered, Germany was producing coal-tar in plenty for its own use, and in the other departments of the industry the relative positions of the two countries was still worse for us. The export of coal-tar colors from Germany, exclusive of alizarines, was 4,646 tons in 1885 and 17,639 tons in 1899. In 1894 the value of the total exports of these colors amounted to £2,600,000, and in 1898 to £3,500,000. The value of the total chemical industry of Germany in 1897 was 46½ millions of pounds; at least a tenth of this might be put down to coloring matters and another tenth to other coal-tar products, making the coal-tar industry in Germany of an annual value of nine to ten million pounds. This remarkable activity has caused vast sums of money to be usefully invested and was giving employment to increasing numbers of work-people. The Badische-Anilin Fabrik in 1889 had a capital of £900,000, which had now been increased by £750,000, while the number of work-people employed, 4,800 in 1896, had risen to 6,485 in 1900. The total capital of the six largest coal-tar color firms in Germany amounted to at least 2½ millions; they employed about 500 chemists, 350 engineers and technical men, 1,360 business managers, clerks, and travelers, and over 1,800 work people. The total capital invested in the coal-tar color trade in England did not exceed £500,000, the total number of chemists employed could not be more than 30 or 40, and the number of workmen engaged in this manufacture probably did not amount to over 1,000. The exports of coal-tar colors from England had fallen from £530,000 in 1890 to £366,000 in 1900. The imports, on the other hand, had steadily increased from $509,000 in 1886 to £720,000 in 1900. The colors used by the Bradford Dyers' Association were 10 per cent. of English make, 80 per cent. German, 6 per cent. Swiss, and 4 per cent. French. It was an apathy toward higher education and research that was the cause of this decadence. Moreover, the encouragement given to chemical research work by these great industries was enormous. Other industries of Great Britain were also threatened. The Germans were busy producing artificially

natural dye-stuffs, largely consumed in England and extensively grown in British possessions; indigo was the latest object of this particular kind of enterprise, and a sum of 1¾ millions sterling was being devoted to the achievement of the extermination of this natural dye-stuff.

UNIVERSITY AND EDUCATIONAL NEWS.

Mr. John D. Rockefeller has promised to contribute $200,000 toward the endowment fund for Barnard College, Columbia University, provided that an equal sum is given by others before January 1, 1902.

The corner stone of the new Medical Building of the University of Michigan was laid on the 15th inst., under the auspices of the State Medical Society, by Dr. Leartus Connor, the president of that body. Addresses were delivered in connection with the ceremonies by the Hon. Regent Kiefer, President Angell, Dr. J. A. McCorkle, professor of medicine in the Long Island College Hospital and a member of the class of '73 of the University of Michigan, and by Professor J. G. Adami of McGill University. The building, which has been made necessary by the rapid growth in recent years of the Medical Department, will contain the laboratories and class-rooms of the departments of hygiene, bacteriology, anatomy, histology and pathology, and the contracts for its erection call for an expenditure of $88,000, exclusive of what may be required for the heating, plumbing and general equipment. The old Medical Building, which has been the home of the Medical School for fifty years, will be remodeled throughout and adapted for the use of the departments of pharmacology, physiology and chemistry.

At the Massachusetts Institute of Technology Capt. William Hovgaard, of the Danish Navy, has been appointed professor of naval design in the department of naval architecture. Dr. H. P. Talbot has been made head of the department of chemistry. Dr. Talbot has for some years past been professor of analytical chemistry, and, since the departure of Dr. Drown, has in a measure acted as head of the department.

Mr. Henry M. Huxley has been made Hemenway fellow and assistant in anthropology at Harvard University.

The New York *Evening Post* states that D. K. Zangogiannis, who was appointed professor of pedagogy at the University of Athens two years ago, and who had made a special study of German educational systems, has been deposed by the Government because of an article he wrote for a German periodical in which he criticised the Greek high schools.

Dr. John Young, professor of natural history at Glasgow, has been obliged by the condition of his health to resign his chair after thirty-five years' service in the University. He will continue to act as curator of the Hunterian Museum.

Dr. Purser, professor of the institutes of medicine in the School of Physic, Trinity College, Dublin, has resigned the chair he has held for twenty-seven years.

At Trinity College, Cambridge, the annual election to fellowships has been held, when four vacancies were filled. The new fellows in the sciences are Harold Albert Wilson, B.A., advanced student; certificate of research 1899 for papers on 'The electrical conductivity of flames containing salt vapors,' 'Velocity of solidification,' 'The influence of dissolved substances and of electrification on the re-formation of clouds,' and 'On the variation of the electric intensity along the electric discharge in rarefied gases'; Allen scholar, 1900; Clerk Maxwell scholar, 1901: and James Hopwood Jeans, B.A., bracketed second Wrangler, Mathematical Tripos, Part 1, 1898; First Class, Division 1, Mathematical Tripos, Part II., 1900; Isaac Newton student, 1900; Smith's Prize, 1901.

Dr. H. Erdmann, of the University of Halle, has been appointed to a full professorship of inorganic chemistry, in the Technical Institute at Berlin. Dr. G. A. Gmeiner has been appointed professor of mathematics in the German university at Prague.

On page 620 of the last issue of Science the word 'geological' was omitted before the word research in the sixth line.